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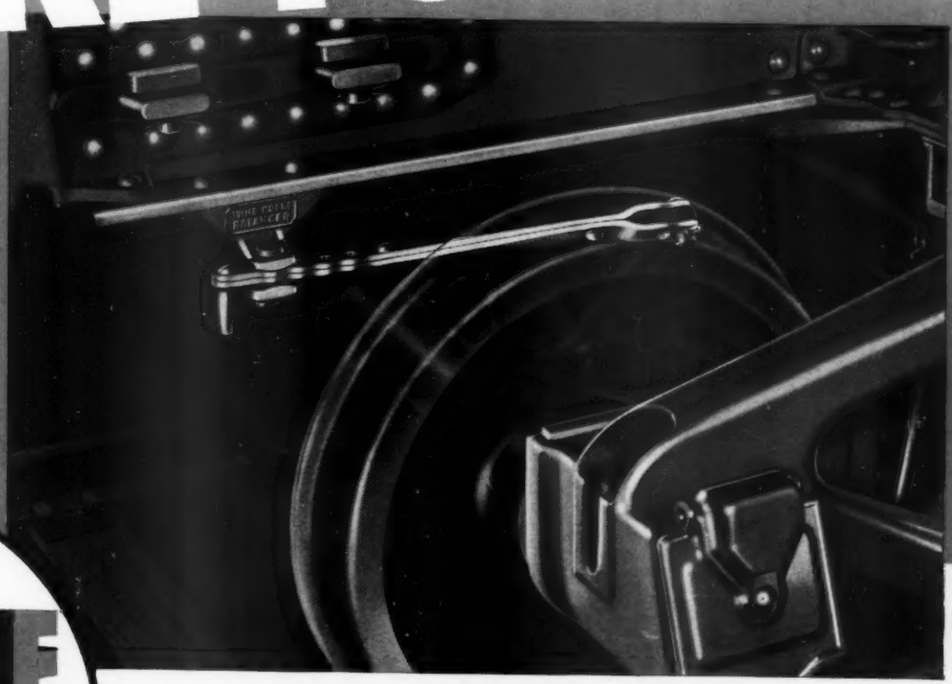

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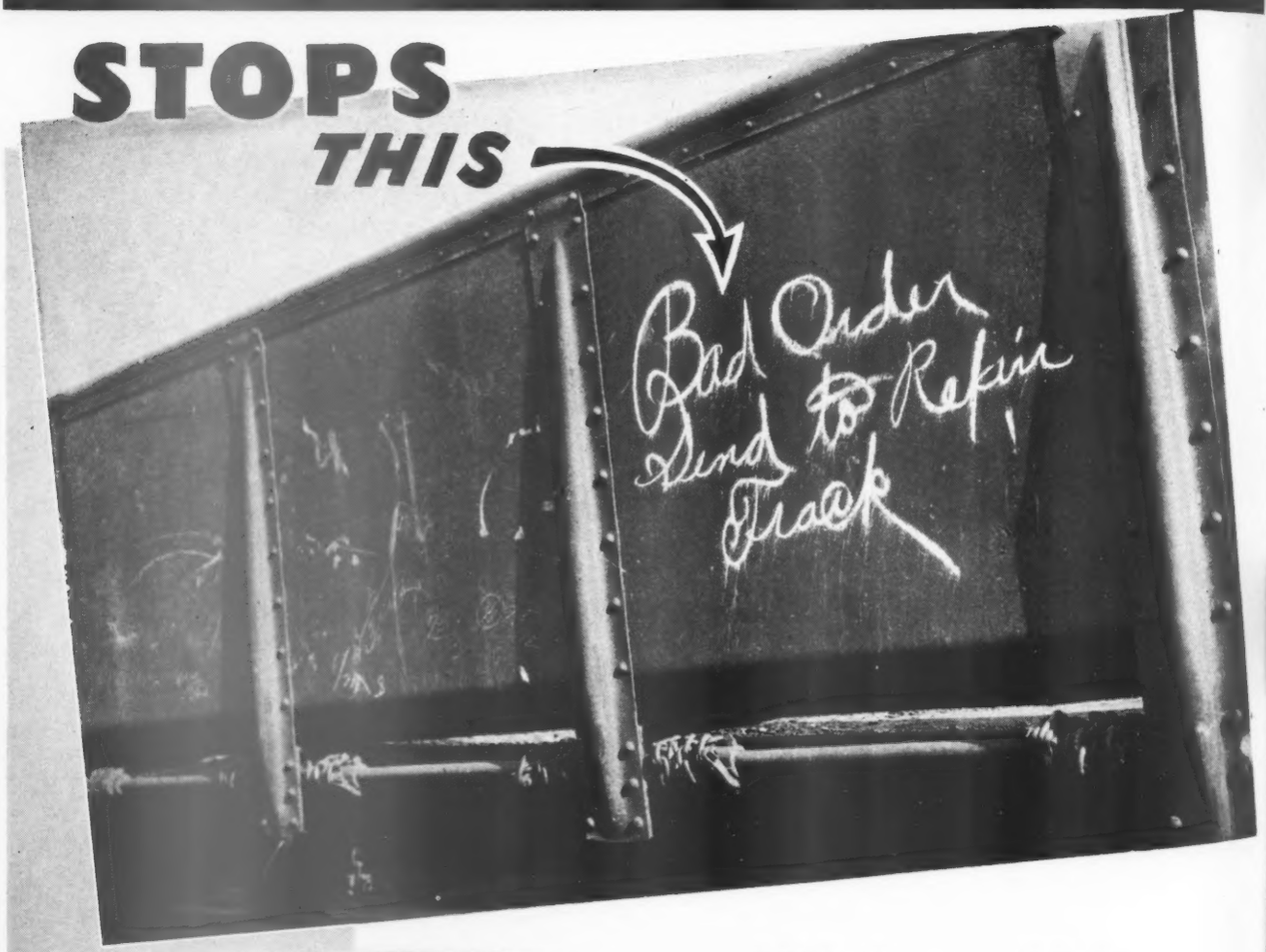

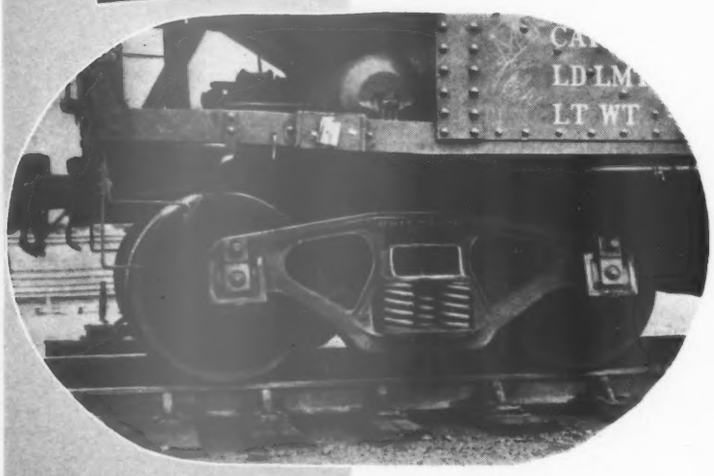

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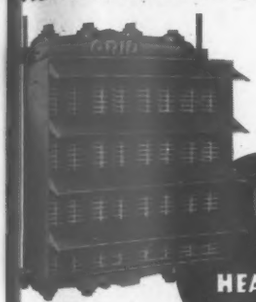

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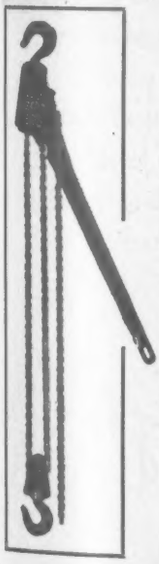

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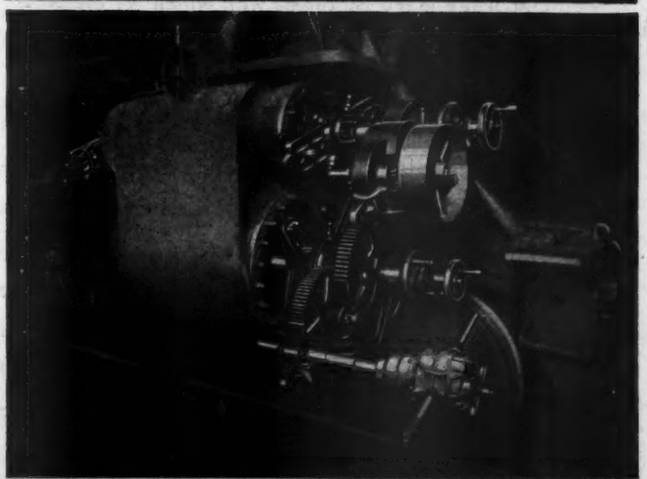

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THE EDITOR'S DESK

PUBLISHERS' PROBLEMS

Critical materials are giving the publishers of newspapers and periodicals much concern. Business papers, such as ours, are being called upon to render all sorts of services, in the editorial and advertising pages, to various governmental projects and agencies which are interested in winning the war. Meanwhile, the compelling needs of the industry which we serve—the railroads and transportation—are such that we are constantly being challenged to render a larger and larger service to our constituency. Then, too, like all other agencies, we are faced with difficult manpower problems within our own organization.

Of the many problems with which we are faced, that of an adequate supply of paper upon which to print the magazine is the most difficult, although it is not the only material that we use that is on the critical list. We have tried to control the situation in such a way that our readers and advertisers would not suffer or be inconvenienced. The size of the type page has been maintained, but the narrowness of the white margins, in reducing the size of the over-all page, has detracted somewhat from the artistic appearance of the paper—and yet, like changes in the styles of women's hats, or the cuffs on men's trousers, we soon became accustomed to the altered appearance.

In the effort to meet the requirements of the W.P.B. we have gone to the use of 50-lb. paper stock, instead of 55-lb., and a still further reduction in the weight will be made when the present supply is replaced. Fortunately our printers have shown special skill in printing on the lighter stock and we are hopeful that, except for the weight of the finished book, the lighter-weight stock will not be unduly noticed.

We have felt that rather than reduce the number of pages in the magazine, the purposes of our readers and advertisers would be better served by making the necessary savings in other ways. We bespeak your patience and co-operation. Rest assured, however, that we shall do our level best to conform to the necessities which confront us and at the same time render a high standard of service to our readers.

Roy V. Wright

RAILWAY MECHANICAL ENGINEER

(Name Registered, U. S. Patent Office)
With which is incorporated the RAILWAY ELECTRICAL ENGINEER.

Founded in 1832 as the American Rail-Road Journal

AUGUST, 1943

Volume 117 *No. 8*

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Erie Trains

Mechanical Supervisors

All supervisors teach—Training of new and up-graded employees emphasized—Job methods training important—Safety record favorably affected — Employees interested

As a part of its continuous training program the Erie adopted a program formulated by the Training Within Industry Division of the War Manpower Commission for use in instructing its supervisory personnel in better methods of teaching the employees under their jurisdiction the most effective way to carry out their assigned duties. The instruction will be given to all men holding supervisory rank in the mechanical department as well as to supervisors in the various other departments of the road's organization. The instruction is also being followed by further training for supervisors in the study of job methods, a recommended program of the Manpower Commission.

In its essentials the program follows successful methods of foremanship training used in other fields but departs from the ordinary in the use of a skeletonized training manual and in dependence upon a series of charts to stimulate discussion in conference groups which are limited in size to permit the full participation of all members. Four main subjects are covered: (1) how to teach a man to do a job; (2) how to handle questions, objections or grievances; (3) how to encourage and maintain enthusiasm; and (4) how to teach a person to do a job safely. Other subjects are to follow.

The conference group sessions for executives and key men from the various departments and divisions on the railroads are conducted by the educational director of the Erie at its home office at Cleveland, Ohio. Approximately 225 of these men have been trained and many of them are now serving in the teaching force which carries on the training schedules at various points on the road for other supervisors. Included among the teachers who have been trained in the Cleveland training conferences are division superintendents, shop superintendents, master mechanics, general foremen, division car foremen, track supervisors, division engineers, passenger agents, general freight agents, claim agents, and accounting and clerical supervisors. Classes are held wherever groups can be assembled most conveniently and arrangements are made to insure that no one in a supervisory capacity will fail to receive the instruction.

How to Teach a Man to Do a Job

Although all subjects taught have a definite place in the training program on the Erie, the most important at present in all departments, particularly in the mechanical department, appears to be the training of supervisors in teaching men to do a job. To accomplish this purpose, training is given in the "sure-fire" method of getting a man to do a job safely, correctly, quickly and conscientiously.

Practical class demonstrations are used to illustrate the fact that merely telling a workman how to do a job is not enough to insure successful performance. Additional demonstrations clearly prove that showing alone is not a satisfactory method of teaching a learner to understand the work required of him. Throughout all lessons it is constantly emphasized that, "If the learner hasn't learned, the teacher hasn't taught." Preparation for instruction is stressed because it is believed that it is as important that a teacher know how to get ready to instruct as it is actually to teach. The preparation of a job break-down sheet is an essential part of the Erie method. The principal steps of any operation are listed on this sheet, together with the key points to be stressed

ERIE JOB BREAKDOWN SHEET

Name of Job: Assembly of E7 reducing valve

Purpose of Job: To limit brake cylinder pressure

Important Steps	"Key Points" - knacks, hazards, "feel", timing, special information
1-Body in left hand	Large opening up
2-Apply regulating nut to body	Lip down Screw down until lip reaches 3/32-in. hole in body
3-Apply jam nut	Screw hand tight against regulating nut
4-Apply valve to seat in valve body	Valve seat down, use hair pin spring holder to guide valve into valve body
5-Apply valve stem	Connection end seated in countersunk hole in valve
6-Apply spring over valve stem	
7-Apply adjusting nut	Hex end up, insert first finger of left hand in hole at bottom of valve body and raise off its seat about 1/4 in. Then enter valve stem into regulating nut screw nut down hand tight
8-Apply cap nut to adjusting nut	Screw all the way down hand tight

A breakdown sheet prepared for use in a class group—Similar sheets are now being prepared for each repetitive shop operation

during training. This sheet serves as a guide to the instructor and is not given to the learner. Its use leaves little likelihood that any step required in the correct performance of any task can be overlooked, and a trainee handicapped by his supervisor's oversight.

Tell-Show-Repeat-Discuss-Check

The essential features of the "sure-fire" method are simple. A learner must first be told how to do a job, then shown; then told and shown until the instructor feels satisfied that the learner has absorbed all that is necessary to perform the job in a satisfactory manner. When this point has been reached the learner must demonstrate his ability to the satisfaction of the teacher, being corrected immediately if he makes an error.

It may be necessary for the instructor to repeat again and again and have the learner make a number of attempts until there is a successful performance. Repetition of the performance by the trainee should be required until the instructor is sure that the job is thoroughly understood and that continued correct results will be obtained. In no case should the word of the learner be taken that he understands; the teacher must know that the learner knows. Discussion of any problems involved often speeds learning by clearing up doubtful points immediately in the learner's mind. Even after putting a new man on his own, occasional checks should be made by the teacher to be certain that the desired level of performance is being maintained.

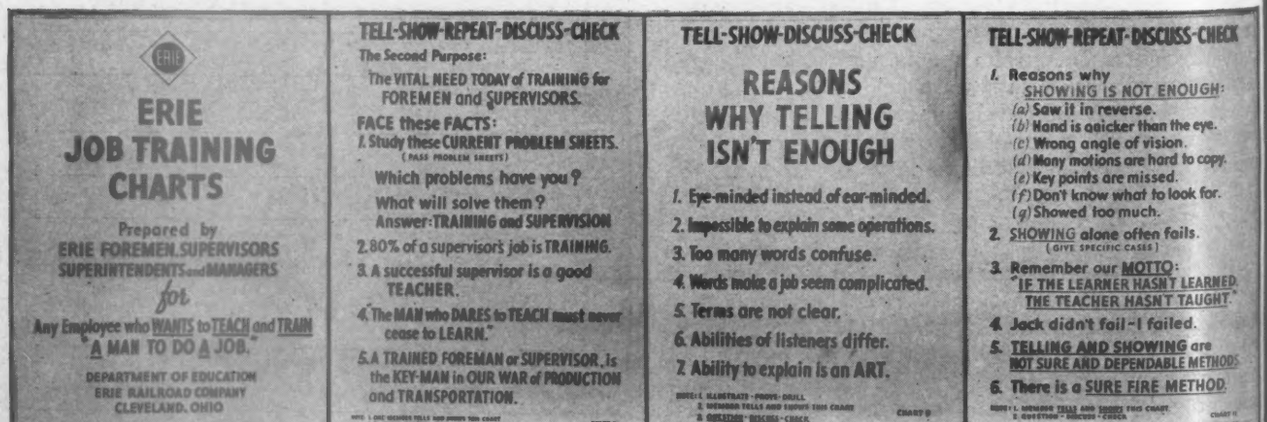
Has It Worked?

This brief summary of the job instructor phase of training leads naturally to the question of determining the effect which the program has had in the training of mechanical personnel. It is difficult to evaluate the worth of the program in terms of increases in shop output, reduction in pre-unit cost of production, or improvement in quality of workmanship. The training of supervisors in instruction methods has had a part in and will continue to affect all of these factors. Particularly evident, however, is a toning up of the entire shop personnel, foremen and workmen, at each of the points which were visited. Men appear to be interested in their work and in the best methods of performing that work.

Among the concrete instances which can be cited is that of a mechanic who finished his apprenticeship and served until 1924 on the erecting floor at one of the Erie's locomotive shops. In his apprenticeship course this man had had no machine experience; at that time it was customary to distinguish between "floor men" and "machine men." In 1924, this man left the service of the Erie and was employed for 18 years as a chauffeur in a private family and so might have been expected to have lost all railroad mechanical skill. After his return

The machining of stoker screws reclaimed by welding is facilitated by the use of a multiple-head tool holder suggested by a shop employee

to service, he received training under the principles incorporated in the job instructor training course and within a period of six weeks had qualified as a capable and efficient operator on a wheel lathe, journal lathe, 48-in. engine lathe, slotter, 42-in. boring mill, No. 5 milling machine and a shaper. His instructors on each of these tools were shop mechanics who had had instructor training passed on to them by their foreman. At the end of six weeks, this mechanic was being assigned to work on his own responsibility on certain shop operations being performed on the night shift. He was to work without the immediate supervision of any leader or foreman. The shop superintendent was confident that the man's work would be good and stated that the


ERIE
JOB TRAINING CHARTS
Prepared by
ERIE FOREMEN, SUPERVISORS
SUPERINTENDENTS and MANAGERS
for
Any Employee who WANTS to TEACH and TRAIN "A MAN TO DO A JOB."
DEPARTMENT OF EDUCATION
ERIE RAILROAD COMPANY
CLEVELAND, OHIO
TELL-SHOW-REPEAT-DISCUSS-CHECK
The Second Purpose:
The VITAL NEED TODAY of TRAINING for FOREMEN and SUPERVISORS.
FACE these FACTS:
1. Study these CURRENT PROBLEM SHEETS.
(PASS PROBLEM SHEETS)
Which problems have you?
What will solve them?
Answer: TRAINING and SUPERVISION
2. 80% of a supervisor's job is TRAINING.
3. A successful supervisor is a good TEACHER.
4. The MAN who DARES to TEACH must never cease to LEARN."
5. A TRAINED FOREMAN or SUPERVISOR, is the KEY-MAN in OUR WAR of PRODUCTION and TRANSPORTATION.
TELL-SHOW-DISCUSS-CHECK
REASONS WHY TELLING ISN'T ENOUGH
1. Eye-minded instead of ear-minded.
2. Impossible to explain some operations.
3. Too many words confuse.
4. Words make a job seem complicated.
5. Terms are not clear.
6. Abilities of listeners differ.
7. Ability to explain is an ART.
TELL-SHOW-REPEAT-DISCUSS-CHECK
1. Reasons why SHOWING IS NOT ENOUGH:
(a) Saw it in reverse.
(b) Hand is quicker than the eye.
(c) Wrong angle of vision.
(d) Many motions are hard to copy.
(e) Key points are missed.
(f) Don't know what to look for.
(g) Showed too much.
2. SHOWING alone often fails.
(GIVE SPECIFIC CASES)
3. Remember our MOTTO:
"IF THE LEARNER HASN'T LEARNED, THE TEACHER HASN'T TAUGHT."
4. Jack didn't fail—I failed.
5. TELLING AND SHOWING are NOT SURE AND DEPENDABLE METHODS.
6. There is a SURE FIRE METHOD.

Representative charts used in teaching supervisors how to teach others

principles of the training program were primarily responsible for the short time in which this mechanic had been prepared to assume his duties.

Mechanics Are Learning Method

It was interesting to note that the principles of the training program are being passed along to shop mechanics who are responsible for the training of apprentices in the use of various machine tools and the performance of varied shop operations. Conversation with a number of them disclosed that they found it easier to train apprentices assigned to them and that the apprentices themselves responded more quickly to the tell, show, repeat, discuss and check system. It was also plain that the apprentices found this method of instruction far superior to the one more commonly employed in which the mechanic had the attitude "watch me and you're dumb if you can't learn." One apprentice who had been given the opportunity to take the complete course along with a number of foremen and shop mechanics and who looks forward to some day becoming a supervisor himself felt that his apprenticeship training had been more valuable and his prospects of success later improved. Other apprentices felt that they were making more rapid progress because of the application of the training principles by their instructors.

Job Breakdown Sheets

Another effect which the program has had in the shops of the Erie has resulted from the use of job breakdown sheets in the training class groups. The various shops are now preparing and filing for use job breakdown sheets on all operations which are more or less repetitive in the repair and maintenance of motive power and rolling stock. This job study is resulting, in many instances, in a simplification of procedures and in the standardization of work methods. The principle of standardized procedures is not new but the study involved in the preparation of the breakdown sheets for instruction purposes has revealed that the practice was not being followed out as fully as it might have been.

Many of the mechanics are now initiating ideas for better production methods because of the general interest being displayed in the shops, especially in the study of machine-tool operations. In fact, hundreds of suggestions have been received from shop employees as a result of the encouragement given them to participate in the development of better procedures. Many of these have been adopted and have materially affected either the quantity or quality of output. Every idea received is given careful consideration by those responsible for shop production and a very high percentage of the suggestions made have proved to be useful. Many of the men present their ideas worked out in detail, others call attention to possibilities for applying new methods but find it necessary to rely on other workmen or foremen for assistance in developing their suggestions.

Typical of the suggestions adopted are the following: a portable boring bar arrangement for machining the sealing ring on stokers; improvements to automatic devices in use in the flue shop; an automatic set-up which has speeded the sharpening of circular saws; a steady rest for a milling-machine arbor when two cutters are being used; a change in design of a whistle shield which required less material and lowered the cost per unit; wooden templets for use with a gas-cutting machine; changes in a monorail crane system to expedite material handling; a device for applying valve chamber bushings which uses a 35-ton journal jack supported by rods and a plate fastened in place on the valve-chamber studs; a sand-blast unit for cleaning the inside of angle-cock caps; a rack for the storage of pistons, and a set-up for machining stoker screws built up by welding.

Job Methods Training Program

It is expected that even more of these suggestions will be forthcoming as the effect of the job methods training program now being given reaches all shops on the railroad. Careful study of all details of present methods of work performance is followed by the development of better procedures through the elimination of unnecessary details, the combining of operations when possible, the rearrangement of tools, machinery, work benches, etc., when necessary to achieve better results, and the simplification of every detail possible. Foremen who have already concluded their work in job-instructor training are finding this additional program is equally valuable in meeting present day demands in the shops.

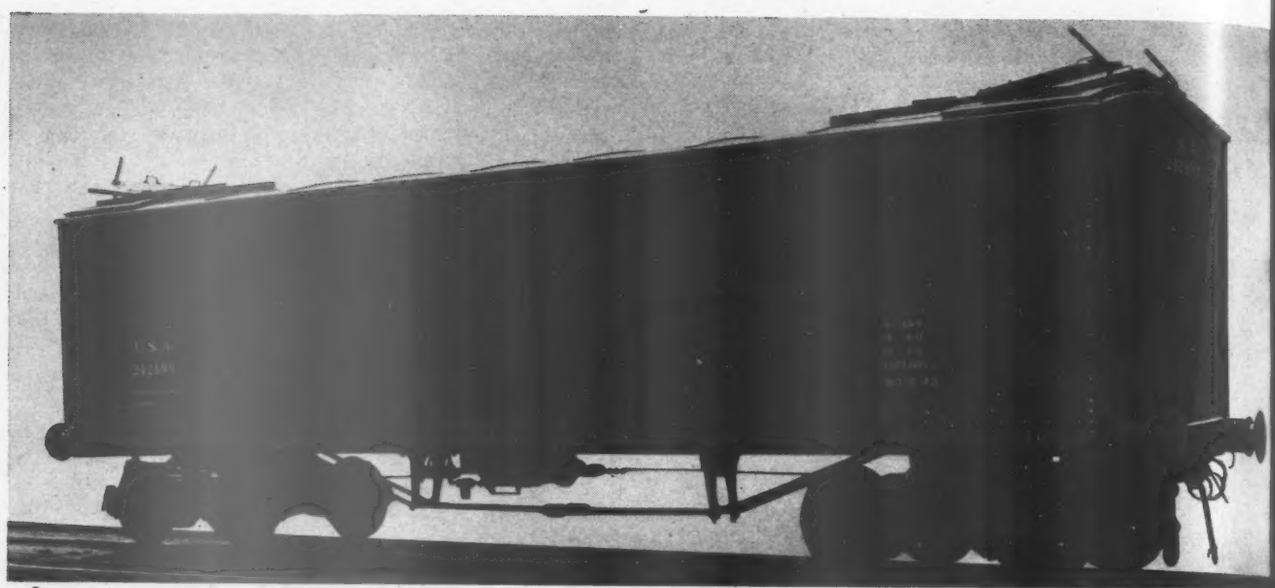
New Personnel Trained

New employees in the mechanical department are being hired monthly at the rate of approximately six per cent of all employees in the department. The absorption of these new employees into the working force and the training of workers assigned to new duties is done in accordance with the instruction steps of job instructor training. No additional burden is placed upon supervisors because the training program assures good results in the development of competent workers.

Safety

The application of the principles of job instructor training has helped greatly in the training of new men and old employees in the safe performance of their duties. Although safety had been stressed before the new training schedules were devised it has been found that "Sure-Fire" safety instruction tends to form safe working habits at the beginning of a man's employment.

Sharpening of circular saws has been speeded and the cost of the operation considerably cut as the result of the thoughtful interest in his work displayed by the employee photographed with a set-up which he devised



Plywood-sheathed, steel-framed refrigerator car built for the War Department for foreign service

American Car and Foundry Company Builds

Plywood Refrigerator Cars

Steel framed design using plywood for sides, ends and roof lining was built for foreign service — Cars have conventional trucks and brake equipment

THE American Car and Foundry Company recently completed at its Chicago plant an order of 200 refrigerator cars of steel and plywood construction designed for the War Department for foreign service.

The underframes of these cars are of all-steel construction with center sills consisting of 31.3 lb. Z-sections; side sills 9-in., 13.4-lb. channels, and end sills of 5/16-in. pressed steel. The center sills are further reinforced by two 1¾-in. truss rods under the sills. The bolsters are fabricated pressed-steel assemblies with built-up welded center fillers. The cross-bearers likewise are of pressed steel with top and bottom cover plates. The floor supports consist of 6-in. channels, wood floor nailers, with a 25/32-in. sub-floor, 1¼-in. tongue-and-groove main flooring, and 2½-in. Fiberglas floor insulation. The conventional floor racks of wood extending from bunker to bunker are a part of the construction. The cars have cast-steel buffers, with drop-forged European-type screw couplings and Cardwell-Westinghouse type D-10 draft gear.

The Superstructure

The superstructure framing consists of 3/16-in. pressed-steel side posts; 3-in., 6.7-lb. Z-section door posts, and 3-in. angle corner posts. The end braces are 3-in., 5.1 Z-sections. The carlines consist of 4-in. by 3-in. angles with 3/16-in. pressed-steel roof flashing, and a roof ceiling of ⅜-in. plywood. The inside side sheathing and inside end sheathing are also of plywood of the same thickness. Plywood, ½ in. thick, is used as the outside side and end sheathing.

Fiberglas insulation is used throughout, with a thickness of 4 in. in the roof and 3 in. in the sides and ends, that in the floor being 2½ in. The floor insulation is continuous from bunker to bunker between the sub- and main floors. The side and end insulation is in panels set in between the horizontal and vertical nailing strips. The roof insulation, likewise, is in panels, located between the ridge-pole and side-plate wood furring. The joints between the plywood panels on sides, ends, and roof are covered with wood battens. Divided ice bunkers with flexible ice pans are part of the equipment.

The side doors of these cars are the 4-ft. refrigerator type door with Miner fixtures. There are bunker hatches at the four corners of the roof fitted with Azee fittings.

Trucks and Brake Equipment

The trucks under the cars are the 40-ton capacity spring plankless type, having cast-steel side frames and

(*Continued on page 355*)

roblems of

Reducing Boiler Explosions*

By Ray McBrian†

Educating enginemen as to the effect of grade on water level—Search for a steel which retains more strength at high temperatures

Boiler explosions, as so termed on railroads, are generally due to overheating of the locomotive fire-box crown sheet under low-water conditions. There are other causes which occur at rare intervals, such as breakage, defective material, corrosion-fatigue, strain aging and, as in the case of stationary boilers, intergranular embrittlement.

In the February, 1943, issue of the *Railway Mechanical Engineer*, John M. Hall, director of the Bureau of Locomotive Inspection, called attention to the increases in boiler explosions which had occurred since the last fiscal year of the bureau as closed on June 30, 1942. Seventeen such explosions had occurred since last July 1, which resulted in the death of 14 experienced enginemen, firemen and trainmen, and serious injury to 46 others. He stressed the importance of enginemen and firemen being alert with respect to the water level in the locomotive boiler.

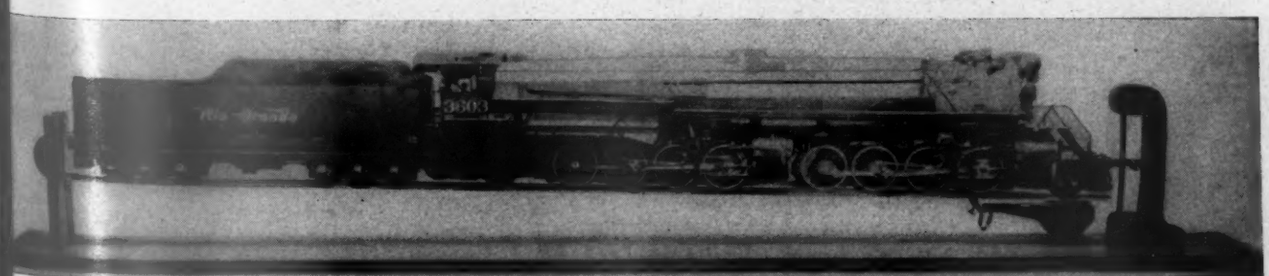
Boiler Model Helps in Educational Campaign

In connection with an educational campaign, the Denver & Rio Grande Western has constructed and is using a hollow model of a locomotive boiler so that enginemen on this road may actually see what happens to the water level in a locomotive on changing grade. The model is approximately 3½ ft. long, and made from plywood and celluloid. A side view photograph of a locomotive was enlarged, as shown in one of the illustrations, to the desired size, and pasted on ⅝-in. plywood. The outline was cut out and the resulting engine mounted on a pivot so that it can be set to any grade from plus four to minus four per cent. An outline scale model of the upper half of the boiler was built from 1/16-in. celluloid glued with acetone. The boiler is complete with crown sheet, brass rods for the upper flues, steam dome and water glass. Outlines of the dry pipe and fountain pipe are pasted in proper location on the rear. A large rubber bulb with hose connection and pinch clamp, connected to the boiler, allows variation of the water level in the boiler. A table of ruling grades is pasted on the base, together with operating instructions.

It is the intention to have each engineman individually inspect and operate the model to see the effect of grade on water level.

In addition to this type of educational campaign, investigations as to improvements in materials and the effect of syphons as added safety factors are being studied. In fact, the purpose of this paper is to discuss briefly one phase of metallurgy which may not be generally understood, namely the effect of temperature on the strength of materials, and to suggest that by the use of a steel with greater strength at high temperatures in combination with syphons, an added factor of safety is introduced. The study of an explosion which occurred on the D. & R. G. W. some time ago, and of a low water condition which resulted only in the bagging of such an

Microstructure (200 diameters) of crown sheet near the point of failure



Locomotive model which shows changes in the level of the water in the boiler on varying grades

* An abstract of a paper presented at the annual meeting of the Association of Railway Claim Agents held June 16 at the Hotel Sherman, Chicago.

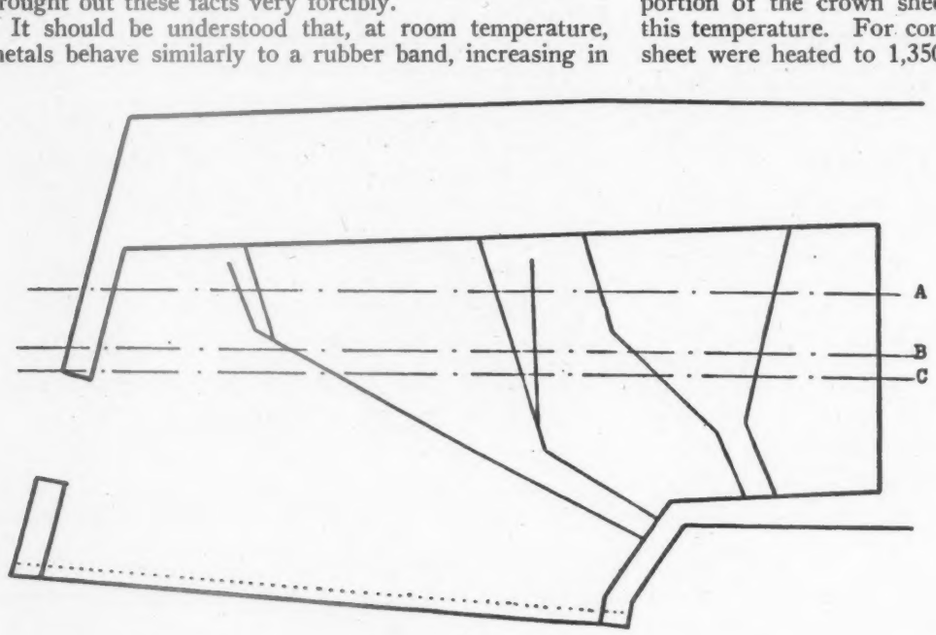
† Engineer of standards and research, D. & R. G. W., Denver Colo.

alloy steel in a locomotive equipped with syphons, brought out these facts very forcibly.

It should be understood that, at room temperature, metals behave similarly to a rubber band, increasing in length when a load is applied, and returning to their original length when the load is removed. This increase in length is directly proportional to the load applied, for loads within the elastic limit of the metal.

At high temperatures, the behavior of metals is different. When loaded, they increase in length and the stretching continues at a fairly constant rate, eventually increasing with reduced section until failure occurs. This reduction of section, or stretching of metal, is found when overheating occurs, and in our investigation of the explosion mentioned, this was the case. Metallurgical examination was made of the failed material under the microscope.

The microstructures found at various locations around the firebox showed that maximum temperature was reached at a point coincident with the origin of the explosion and established that the maximum temperature had been between 1,350 and 1,400 deg. F.



Sectional drawing showing various water levels at which syphons continue to function

Another illustration shows the miscrostructure of portion of the crown sheet which had been heated this temperature. For comparison, pieces of the cro sheet were heated to 1,350 deg. F., 1,650 deg. F., a to 1,800 deg. F., as shown in the three other micro photographs.

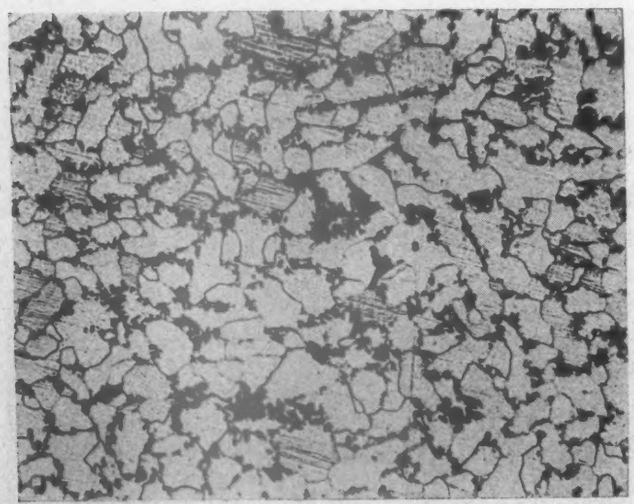
The effect on the microstructure of heating to the different temperatures is shown, and by the comparison with these photographs the temperature to which th

Results of Comparative Tests of Two Steels at 1,385 deg. F.

	Tensile strength, lb. per sq. in.	Elongation per cent in 1 in.
A. A. R. carbon firebox steel	5,600	98.5
A. S. T. M. A.-204 firebox steel (Carbon-molybdenum)	13,400	128.0

Using formula $S = \frac{Pa^2}{4\ T^2} = 8{,}000$ lb. per sq. in.

Where S = maximum working fiber stress, lb. per sq. in.
P = boiler pressure, = 280 lb. per sq. in.
a = staybolt pitch = 4 in.
T = thickness of plate = 5/16 in.



Microstructure of comparative piece of a crown sheet heated to 1,350 deg. F.—Comparison with the structure of the failed crown sheet indicated that the failure had occurred at 1,350 to 1,400 deg. F.

crown sheet had been heated was determined. Th structure obtained by heating to 1,350 deg. F., wa almost identical to that shown in the crown sheet sample All of the micrographs were made at 200 diameters.

Carbon-Molybdenum Retains High Strength at High Temperatures

To determine the strength of the crown sheet at th temperature at which it failed, tensile tests were made at 1,385 deg. F. Tensile tests were also made of carbon-molybdenum firebox steel at this same temperature for comparison. The molybdenum content of the firebox steel was 0.50 per cent. The results of these tests are given in the table.

They indicate that the tensile strength of the crown sheet where it failed was approximately 5,600 lb. per sq. in., or only one-ninth the value at room temperature. The carbon-molybdenum firebox steel at this temperature had a tensile strength of 13,400 lb. per sq. in., or more than double the strength of plain carbon steel. To demonstrate that the reduction in strength due to overheating alone could cause the failure of this firebox the calculations were made, using the formula shown under the table. A 3/8-in. plate and a staybolt pitch of 4

ive a working stress of about 8,000 lb. per sq. in. for lb. boiler pressure.

rom the high temperature tests, it was shown that the plain carbon steel the strength at 1,385 deg. F. only 5,600 lb. per sq. in., or 2,400 lb. per sq. in. r than the working stress at that temperature. It found then that the boiler pressure alone was suf- nt to cause failure when the temperature of the crown t approached 1,350 deg. F. Also it was found that molybdenum steel, due to its higher strength, would have failed at this working stress and the tem- ature of 1,385 deg. F. which was reached in the n sheet.

The effect of the use of such alloy steels is to pro- e an additional factor of safety through the strength- g of the steel at the higher temperatures. Along h these metallurgical studies, a test was made on cale model firebox to show the action of syphons er low water conditions. The model was one-eighth le of a locomotive equipped with five syphons, three the firebox and two in the combustion chamber. The demonstrated that the syphons will function after water level is below the crown sheet and that the box syphons function after the combustion chamber hons have ceased to discharge water over the crown et. The results of this test are given in a sectional wing which shows that when the water level *A* was ched, the top row of tubes adjacent to the back flue et became dry. When the water level was at *B*, part the crown sheet in the combustion chamber and next flue sheet became dry. When the water level reached most of the crown sheet in the combustion chamber ame dry. But the firebox syphons continued to ction.

Such investigations aid in securing better materials d in preventing the occurrence of explosions, but, as ted editorially in the June *Railway Mechanical En- eer*, enginemen persist in trying to restore low water face of extreme danger, which leads to the follow- g questions:

"Are enginemen generally aware of the extremely rrow margin of time in which they can be sure of fety after the water first disappears from the bot- tom of the water glass, and also how many railroads have formulated definite rules of action embodying safe procedure to be followed when low water emergencies present themselves?"

Such questions are pertinent as well as the studies to improve materials and appliances, and warrant a con- tinual definite campaign and vigilance to prevent low- water explosions.

Plywood Refrigerator Cars for War Department

(*Continued from page 352*)

double-truss lightweight cast-steel truck bolsters. The center plate and dead lever stop bracket are cast integral with the bolsters. The trucks are equipped with 5-in. by 9-in. A. A. R. "emergency" axles and 33-in., 610-lb. chilled-iron wheels.

The brake equipment consists of Westinghouse KC-1012 equipment with 86-second choke fitting. The hand brake shaft is in the horizontal position with hand brake wheel, pawl and ratchet below each side of the car under the same end.

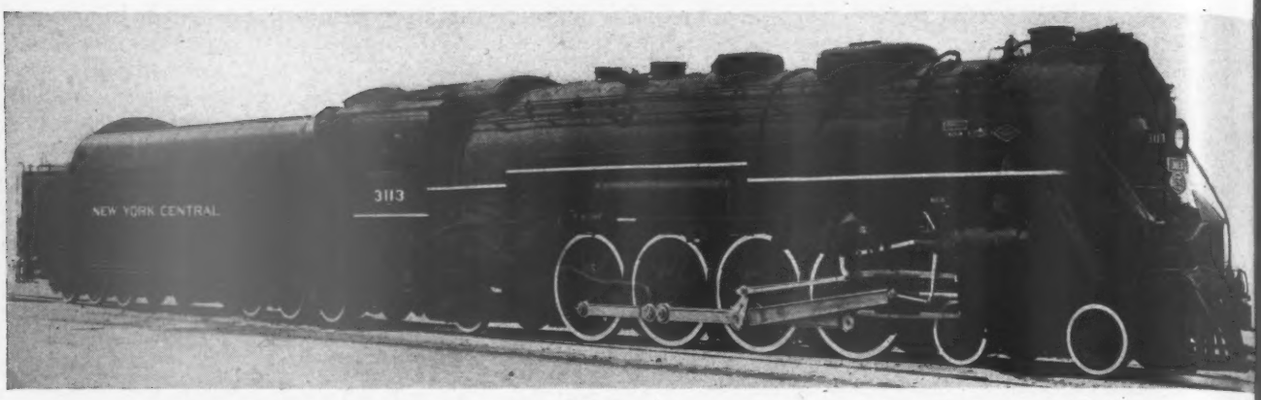
The general characteristics are shown in the table.

General Characteristics of the U. S. Government 35-Ton Refrigerator Car

Length over buffers, ft.-in.	43— ¼
Length over end sills, ft.-in.	39— 5
Length between truck centers, ft.-in.	29— 5
Length between ice bunker bulkheads, ft.-in.	32— 8
Width inside, ft.-in.	6—11
Width over side plates, ft.-in.	8— 2
Width over side sills, ft.-in.	7— 6¾
Height floor to ceiling at center line of car, ft.-in.	6— 9⅞
Height rail to top of roof battens, ft.-in.	11—10⅜
Height rail to top of floor, ft.-in.	4— 7
Height rail to center of buffer, ft.-in.	3— 6
Height rail to center of drawbar, ft.-in.	3— 6
Height weight, lb.	39,900
Gauge of track, ft.-in.	4— 8½
Capacity, tons	35

* * *

4-6-0 locomotive built for heavy passenger and fast freight traffic on the London & North Eastern—The locomotive, designed for service ywhere on the system, has a tractive force of 26,878 lb.; a boiler pressure of 225 lb.; 20-in. by 26-in. cylinders; 74-in. driving wheels, d a weight in working order of approximately 276,000 lb.—All steel castings other than wheel centers, buffer sockets and horns have en eliminated in its construction—The "Springbok" is the first of a series to be known as the Antelope class



New York Central

All-Round Road Locomotives

Built by Lima, primarily for freight service, these 4-8-2 type have 72 in. drivers and develop 59,900 lb. tractive force—Drawbar horsepower estimated at about 4,300 at 60 m.p.h.—Entire group has averaged over 10,000 miles per month since delivery

THE New York Central received 25 4-8-2 type locomotives from the Lima Locomotive Works, Inc., during the period from December 1 to March 4. These locomotives, known as the L-4a class, are the same as the L-3a class, 50 of which were delivered to the railroad beginning in December, 1940, except that the diameter of the driving wheels has been increased from 69 to 72 in. and the diameter of the cylinders from 25½ in. to 26 in., so that there is no appreciable difference in the tractive force of the two types. Since the delivery of the first of these locomotives they have accumulated 1,257,717 miles up to the first of June, with an average of 10,681 miles per locomotive per month.

In a road test one of the L-3 locomotives developed a maximum indicated horsepower of 5,260 and a maximum drawbar horsepower of 4,120 at 58 m. p. h. The L-4's have not been tested, but it is estimated that they will develop a maximum of 5,400 i.hp., and of just under 4,300 db. hp. at 60 m. p. h.

The L-3 class locomotives, 25 of which were equipped so that they were available for both freight and passenger service, demonstrated their capacity to handle heavy passenger service at fast schedule speeds. The new locomotives with their larger drivers are even better adapted for this service. They are a universal road service type.

These locomotives were ordered in February, 1942, and their design was, therefore, not subject to the full impact of the shortages of critical materials which developed rapidly following our entrance into the war. A number of substitutions were called for, however. These included the substitution of steel tubing for copper tubing, the replacement of the bronze bell by a welded steel bell, and the use of steel in the construction of the cab and in the running boards. Aluminum had been used for the cabs and running boards of the L-3 locomotives. This substitution is largely responsible for the increase in the weight of the locomotives of the L-4 class.

The boilers are of the conical type. The firebox has 75.3 sq. ft. of grate area and a 63-in. combustion chamber. The tubes are 20 ft. 6 in. long. Although they a operating at a working pressure of 250 lb., they are d signed for a pressure of 255 lb. This pressure was al the basis of the machinery design.

Boiler Construction

Both firebox and boiler plates are of the basic ope hearth steel. The first shell course is of $^{15}/_{16}$-in. pla while the second and third courses are $1^{1}/_{32}$-in. pla The inside firebox is of welded construction throughou The sheets are laid out so that the grain structure the crown and sides runs longitudinally; the combusti chamber below the crown, circumferentially, and the side throat sheet, horizontally. The bottom of b inside and outside firebox sheets are welded to mud rings at the corners.

The calking edges between the back head and wrapp sheets are electric welded for a distance of about 29 up from the mud ring. The circumferential seam b tween the rear shell course, the wrapper sheets, and t throat sheet, and between the throat sheet and wrapp sheets are seal welded. The usual seal welding is a applied at the ends of the longitudinal joints in the bo shell courses.

There are four 2-in. combustion tubes through each side of the firebox.

The boilers are fitted with the Type E superheater and have the Worthington SA feedwater heater. The fireboxes have Firebar grates and are fired with the Standard HT type stoker with the engine mounted on the tender. The boilers are fitted with the National Aluminite blow-down system.

Foundation and Running Gear

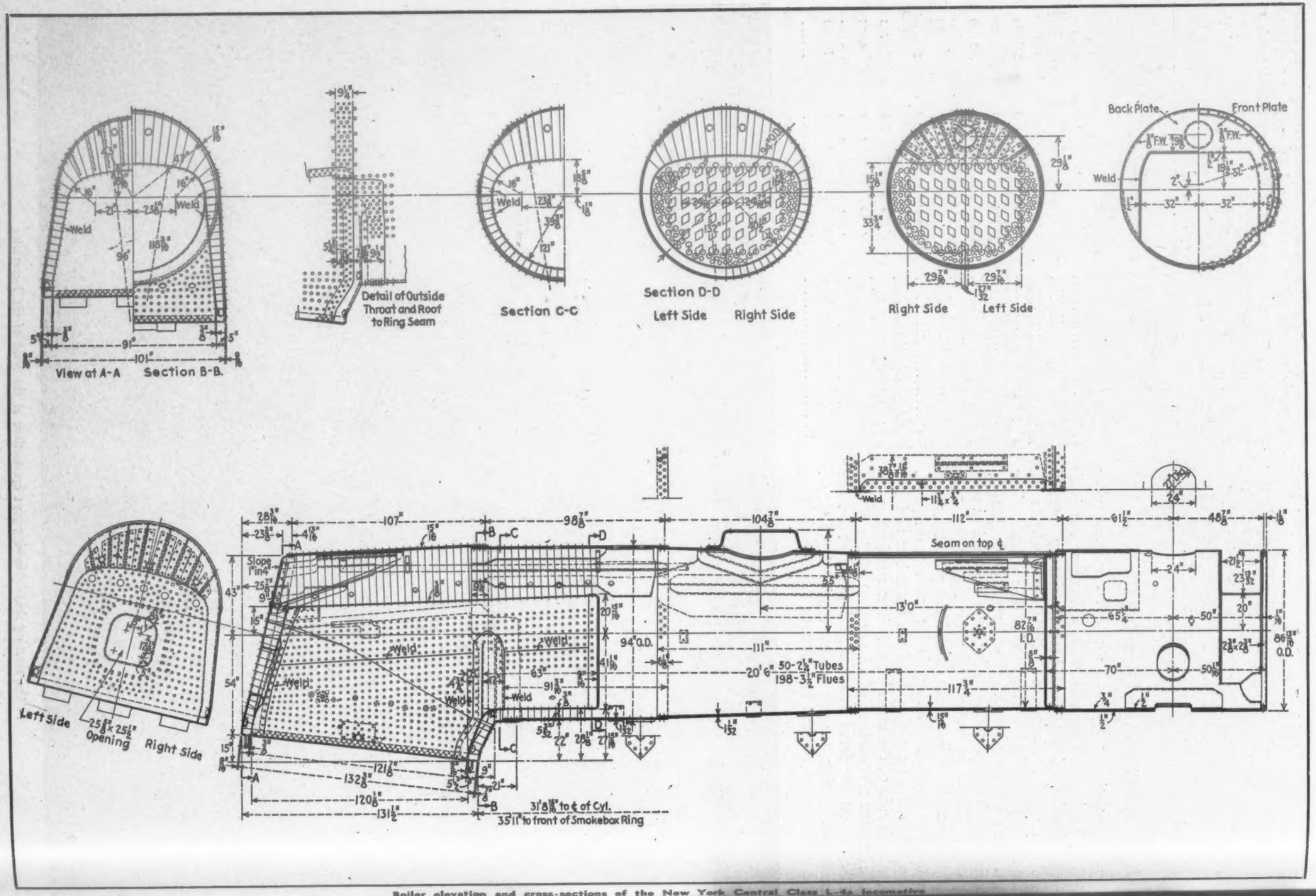
The foundation of the locomotive is a General Steel Castings engine bed in which the cylinders, the back cylinder heads and air-pump brackets are an integral part. On 20 of the locomotives the driving wheels are Boxpok castings and on five, Scullin disc wheels. The axles are all hollow-bored. The driving-axle journal bearings are Timken double-roller type mounted in split housings. There is an end play of 3/16 in. on each side between the driving boxes and the pedestal shoes and the Alco lateral cushioning device provides for 1/2 in. controlled lateral on each side of the front box and 5/16 in. on each side of the main boxes. The cushioning device is set for a resistance of 17 per cent of the weight at the rail on the front boxes and 8 per cent on the main boxes. Spring hangers are conventional gib types.

In counterbalancing the locomotives the out-of-plane effects are taken into account in all driving wheels and the main wheels are crossbalanced by angling the counterweights. The main wheels are counterbalanced to produce equal dynamic effect on both sides of the locomotive. This results in unequal compensation of the effect of the reciprocating parts on the two sides due

Comparison of Characteristics of New York Central 4-8-2 Locomotives

	L-2d converted 2998	L-3a (25)	L-4
Builder	Alco	Alco	Lima
Road numbers	2998	3000-3024	3100-3124
Date built	March, 1930	Dec., 1940	Dec., 1942
Service	Frt. and pass.	Frt. and pass.	Frt. and pass.
Weight on drivers in working order, lb.	257,000	262,000	265,800
Total engine weight in working order, lb.	385,100	388,500	397,300
Weight of tender in working order, lb.	313,500	374,200	377,000
Cylinders, diameter and stroke, in.	25½x30	25½x30	26x30
Driving wheels, diameter, in.	69	69	72
Steam pressure, lb.	250	250	250
Fuel	Bit. coal	Bit. coal	Bit. coal
Grate area, sq. ft.	75.3	75.3	75.3
Firebox heating surface, total, sq. ft.	354	373	373
Evaporative heating surface, sq. ft.	4,556	4,657	4,676
Superheater heating surface, sq. ft.	1,931	2,080	2,103
Tractive force, engine, lb.	60,100	60,100	59,900
Tractive force with booster, lb.	73,850	.....	.....

In the erecting shop—Showing pipe connections at the front of the locomotive



Boiler elevation and cross-sections of the New York Central Class L-4s locomotive

The boiler in the erecting shop

General Dimensions, Weights and Proportions of the New York Central 4-8-2 Type Locomotives, L-4a Class

Railroad	New York Central
Builder	Lima
Type of locomotive	4-8-2
Road class	L-4a
Road numbers	3100-3124
Date built	Dec., 1942
Service	Freight and passenger
Dimensions:	
Maximum curve, deg.-min.	18—30
Height to top of stack, ft.-in.	15—1
Height to center of boiler, ft.-in.	10—1½
Width overall, in.	125
Cylinder centers, in.	91
Length overall, engine and tender, ft.-in.	109—6½
Weights in working order, lb.:	
On drivers	265,800
On front truck	73,100
On trailing truck	58,400
Total engine	397,300
Tender (loaded)	377,000
Wheel bases, ft.-in.:	
Driving	19—0
Rigid	6—4
Engine, total	43—1
Engine and tender, total	95—11½
Wheels, diameter outside tires, in.:	
Driving	72
Front truck	36
Trailing truck	44
Engine:	
Cylinders, number, diameter and stroke, in.	2 — 26 x 30
Valve gear, type	Baker
Valves, piston type, size, in.	14
Maximum travel, in.	8½
Steam lap, in.	1 9/16
Exhaust clearance, in.	5/16
Lead, in.	5/16
Boiler:	
Type	Conical
Steam pressure, lb. per sq. in.	250
Diameter, first ring, inside, in.	82 7/16
Diameter, largest, outside, in.	94
Firebox, length, in.	120½
Firebox, width, in.	90¼
Height mud ring to center line of boiler, back., in.	54
Height mud ring to center line of boiler, front, in.	69
Combustion chamber length, in.	63
Boiler (continued):	
Arch tubes, number and diameter, in.	5—3
Flues, number and diameter, in.	198—3½
Tubes, number and diameter, in.	50—2¼
Length, over tube sheets, ft.-in.	20—6
Net gas area through tubes and flues, sq. ft.	9.56
Fuel	Bit. coal
Grate area, sq. ft.	75.3
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	338
Arch Tubes	35
Firebox, total	373
Tubes and flues	4,303
Evaporative, total	4,676
Superheater	2,103
Comb. evaporative and superheater	6,779
Tender:	
Type	Water-bottom
Water capacity, gals.	15,500
Fuel capacity, tons	42½
Trucks	Six-wheel
Journals, diameter and length, in.	6½ x 12
Wheel diameter, in.	41
Rated tractive force, engine, 85 per cent, lb.	59,900
Weight proportions:	
Weight on drivers ÷ weight engine, per cent	66.91
Weight on drivers ÷ tractive force	4.44
Weight of engine ÷ evap. heating surface	84.98
Weight of engine ÷ comb. heating surface	58.61
Boiler proportions:	
Firebox heating surface, per cent combined heating surface	5.50
Tube-flue heating surface, per cent comb. heat. surface	63.49
Superheater heating surface, per cent comb. heat. surface	24.64
Firebox heating surface ÷ grate area	4.49
Tube-flue heat. surface ÷ grate area	57.14
Superheater heat. surface ÷ grate area	27.93
Comb. heat. surface ÷ grate area	90.02
Gas area, tubes-flues ÷ grate area	0.13
Evaporative heat. surface ÷ grate area	62.08
Tractive force ÷ grate area	795.4
Tractive force ÷ evaporative heat. surface	12.81
Tractive force ÷ comb. heat. surface	8.84
Tractive force × diameter drivers ÷ comb. heat. surface	636.2

to the difference in the angle of the rotating balance required for the two return cranks.

The reciprocating parts on these locomotives weigh 1,535 lb. on each side. The over-balance as it affects dynamic augment amounts to 115 lb. in each front driver, 166 lb. in each main driver, 132 lb. in each intermediate wheel, and 115 lb. in each rear wheel. The ratio of unbalanced reciprocating weight to the total weight of the locomotive is 1/366.

The four-wheel engine trucks are of the General Steel Castings constant-resistance type with SKF inside roller bearings in solid housings, mounted on hollow-bored axles, with 36-in. multiple-wear rolled-steel wheels. The wheel base is 86 in. These trucks are designed for a swing of 4¾ in. each side of the center. They have an initial lateral resistance of 40 per cent and a constant resistance of 33⅓ per cent.

The trailing truck is of the two-wheel Delta type with 44-in. multiple wear rolled-steel wheels. They have Timken roller bearings and hollow-bored axles. There is a complete installation of Timken heat indicators on all locomotive and tender journal boxes.

Both driving axles and engine-truck axles are of normalized carbon-vanadium steel. The trailer axles are medium carbon steel, normalized and drawn. Provision is made for the application of a booster on the trailing truck, also for the future application of air brakes. The truck has a lateral resistance of 20 per cent, both initial and constant. The pedestals both on the engine and trailer truck have spring-steel liners.

Pistons, Rods, Crossheads

The pistons, which are 26 in. in diameter, are of Timken chrome-nickel-molybdenum rolled steel of V-section, and the piston rods are of the same material. The rings are of the bronze-and-iron lipped type furnished by the Koppers Company, American Hammered Piston Ring Division. Both piston and valve stems have King type packing. The length of the piston rods permits removal of the piston heads for the renewal of packing rings without disconnecting the piston rods from the crossheads.

The alligator type crossheads are of Timken chrome-nickel-molybdenum steel with gun-iron shoes. The wrist pin is fitted with Timken roller bearings. The guides are applied to the back cylinder head with the Alco Slidguide attachment. The main and side rods are of manganese-vanadium steel, normalized and tempered. The back-end main-rod bearing is bronze in a one-piece floating bushing operating within a Hunt-Spiller gun-iron fixed bushing pressed in the rod. The floating bushing is flangeless and the main rod is spaced between the side rod and the eccentric crank by floating rings of soft steel. The side-

The cab interior of the New York Central L-4a locomotives

Partial List of Materials and Equipment on the New York Central L-4a 4-8-2 Type Locomotives

Bed castings; engine and trailer trucks; pilot; front bumper; ash pan	General Steel Castings Corp., Eddystone, Pa.
Driving wheels	(20) General Steel Castings Corp., Eddystone, Pa. (5) Scullin Steel Co., St. Louis, Mo.
Engine- and trailer-truck wheels	(10) Armco Railroad Sales Co., Middletown, Ohio (15) Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Tires	American Locomotive Co., Railway Steel Spring Div., New York
Bushings in engine- and trailer-truck frames	Ex-Cell-O Corporation, Detroit, Mich.
Roller bearings—driving-box; trailer-truck; journal-box heat indicators	The Timken Roller Bearing Co., Canton, Ohio
Roller bearings—engine-truck boxes	SKF Industries, Philadelphia, Pa.
Springs	Crucible Steel Co. of America, New York
Spring preservative	Dearborn Chemical Co., Chicago
Lateral cushioning device; Slidguide attachment	American Locomotive Company, New York
Power reverse gear	Franklin Railway Supply Co., Inc., New York
Brakes and signal equipment	New York Air Brake Co., Watertown, N. Y.
Pilot coupler	National Malleable and Steel Castings Co., Cleveland, Ohio
Ferro vanadium for the steels for driving axles, engine-truck axles, main crank pins, and main and side rods	Vanadium Corporation of America, New York
Piston-rod and valve-stem packing; air-pump packing	U. S. Metallic Packing Co., Philadelphia, Pa.
Valve gear	Pilliod Co., New York
Cylinder cocks and operating valves	The Okadee Company, Chicago
Cylinder and valve-chamber bushings; main- and side-rod bushings; piston-valve packing rings	Hunt-Spiller Manufacturing Corporation, Boston, Mass.
Crank-pin bearings	Magnus Metal Div., National Lead Co., New York
Crossheads; piston rods	The Timken Roller Bearing Co., Canton, Ohio
Piston rings	Koppers Company, American Hammered Piston Ring Div., Baltimore, Md.
Blow-off cocks	(15) The Okadee Company, Chicago (10) Wilson Engineering Corporation, Chicago
Jacket steel	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Fire door	Standard Locomotive Equipment Company, Toledo, Ohio
Fire brick	General Refractories Company, Philadelphia, Pa.
Grates	Waugh Equipment Co., New York
Boiler tubes	(10) Globe Steel Tubes Co., Milwaukee, Wis. (15) Republic Steel Corp., Steel and Tubes Div., Massillon, Ohio
Staybolt iron	Joseph T. Ryerson & Son, Inc., Chicago
Flexible bolts; expansion stays	Flannery Bolt Co., Bridgeville, Pa.
Arch-tube plugs; washout plugs; cylinder port plugs	Huron Mfg. Co., Detroit, Mich.
Boiler braces	American Locomotive Co., New York
Exhaust-pipe gasket	Johns-Manville Sales Corp., New York
Continuous blow-down system	National Aluminate Corp., Chicago
Superheater; Tangential steam dryer	The Superheater Company, New York
Stoker	Standard Stoker Co., Inc., New York
Dri-Steam separator for turret drypipe	Dri-Steam Products, Inc., New York
Superheater pipes	(10) Globe Steel Tubes Co., Milwaukee, Wis. (15) Republic Steel Corp., Massillon, Ohio
Throttle	American Throttle Co., New York
Feedwater heater	Worthington Pump and Machinery Corp., Harrison, N. J.
Stoker and feedwater heater gages	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Injector; boiler checks	Nathan Manufacturing Co., New York
Valves and valve trimmings	Ohio Injector Co., Wadsworth, Ohio
Line checks	Crane Co., Chicago
Boiler lagging	Johns-Manville Sales Corp., New York
Smokebox blower fittings	Barco Manufacturing Co., Chicago
Smokebox netting	The W. S. Tyler Co., Cleveland, Ohio
Smokebox front gasket	The Garlock Packing Company, Palmyra, N. Y.
Pipe and pipe nipples	A. M. Byers Co., Pittsburgh, Pa.
Pipe fittings	Corley Co., Jersey City, N. J.
Pipe lagging	Union Asbestos & Rubber Co., Chicago
Safety valves; steam gages; sprinkler	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Cab apron	Inland Steel Co., Chicago
Cab curtains	The Lehon Co., Chicago
Cab sash	O. M. Edwards, Inc., Syracuse, N. Y.
Glass (laminated)	Pittsburgh Plate Glass Co., Pittsburgh, Pa.

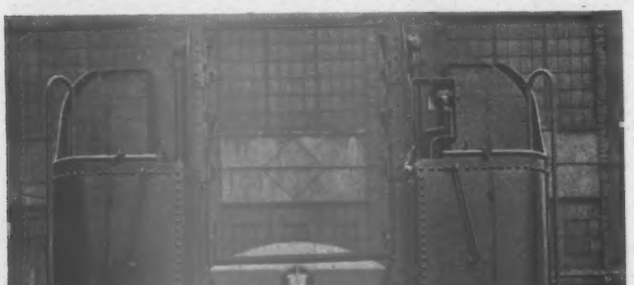
Inside the tender coal space

Cab insulation	The Pantasote Company, Inc., New York
Air gages	Ashton Valve Co., Boston, Mass.
Water column	Nathan Manufacturing Co., New York
Water gages	The Okadee Company, Chicago
Steam-heat regulator and gage	Vapor Car Heating Co., Inc., Chicago
Sanders	Graham-White Sander Corp., Roanoke, Va.
Tubing for air lines to sanders, bell ringer and whistle; for feed lines from force-feed lubricators	Bundy Tubing Co., Detroit, Mich.
Headlight	The Pyle-National Company, Chicago
Train control	General Railway Signal Co., Rochester, N. Y.
Whistle	Nathan Manufacturing Co., New York
Low-water alarm	Barco Manufacturing Co., Chicago
Valve Pilot	Valve Pilot Corporation, New York
Lubricators	Detroit Lubricator Co., Detroit, Mich. Nathan Manufacturing Co., New York
Grease fittings	Alemite Div., Stewart-Warner Corp., Chicago
Bell ringers	Railway Service and Supply Corp., Indianapolis, Ind.
Paint	The Glidden Company, Cleveland, Ohio
Piping between engine and tender	Barco Manufacturing Co., Chicago
Drawbar between engine and tender	Franklin Railway Supply Co., Inc., New York
Tender:	
Frame; trucks	General Steel Castings Corp., Eddystone, Pa.
Springs	Crucible Steel Co. of America, New York
Axles	Bethlehem Steel Co., Bethlehem, Pa.
Bearings	SKF Industries, Philadelphia, Pa.
Journal-box heat indicators	The Timken Roller Bearing Co., Canton, Ohio
Clasp brake rigging	American Steel Foundries, Chicago
Wheels	(10) Armco Railroad Sales Co., Middletown, Ohio (15) Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Draft gear	Waugh Equipment Company, New York
Draft-gear attachment; swivel butt coupler	The Symington-Gould Corp., New York
Swing-hanger bushings	Ex-Cell-O Corporation, Detroit, Mich.
Coal pusher	The Standard Stoker Co., Inc., New York
Washout plugs	Huron Mfg. Co., Detroit, Mich.
Piping	A. M. Byers Co., Pittsburgh, Pa.
Manhole and back-up lamps	The Pyle-National Company, Chicago
Tank-water level indicator	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Steam-heat connection and coupling head	Vapor Car Heating Co., Inc., Chicago

rod bearings on the main and intermediate crank pins are also bronze floating bushings. The front and back crankpin bearings are fixed bronze bushings.

The main crank pin is manganese-vanadium steel, normalized. The others are medium carbon steel, normalized and drawn. All except the front crank pins are hollow bored.

Steam is admitted to the superheater through a Tangential steam dryer, and the American multiple throttle



Steam, air and water connections at the front end of the tender

is included in the superheater header. The lightweight piston valves are 14 in. in diameter driven by a Baker gear with McGill Multirol needle bearings. The packing rings are Hunt-Spiller gun iron. The power reverse gear is the Franklin Precision type.

Lubrication and Cab Fittings

There are two force-feed lubricators on each locomotive. That on the right side feeds valve oil to the steam-chest cylinders, the air compressors, the stoker engine, and the feedwater hot pump. The lubricator on the left side supplies engine oil to the valve stem crosshead, the main guides, the driving boxes, the engine-truck and trailer-truck pedestal faces, to the trailer-truck center pin, and to the radial buffer between the engine and tender. In addition to the extensive oil lubrication, Alemite soft grease fittings are applied on the valve motion, power reverse gear, and throttle rigging.

To keep within clearance limits on curves the cabs are slightly tapered, front to rear. They are of riveted-steel construction with wood lining and Agasote insulation. The windows are Pittsburgh laminated glass in Edwards steel sash. The cab curtains are of Mulehide. The boilers are protected with Barco low-water alarms. The blower is the only auxiliary supplied with superheated steam which is piped directly from the superheater header. Saturated steam for the remainder of the auxiliaries is taken from a turret located on the roof sheet just ahead of the cab. This is supplied through two drypipes which are fitted with Dri-Steam separators in the dome.

The engine-tender drawbar is the Unit Safety type and slack is controlled by the Franklin E-2 type buffers. Barco flexible joints are air and steam connections.

The Tenders

The tenders are of rectangular water-bottom type built up on General Steel Castings water-bottom tender frames. The tank is of riveted construction with a single riveted joint between the side sheets and frame, the edges of which are welded inside and out. A Standard type DA coal pusher is installed in the tender. There is also a water scoop.

These tenders are of the same large capacity as those first used behind the L-3 class locomotives. Their coal capacity of 42½ tons is a large factor in the versatility of these locomotives in universal main-line service.

The six-wheel tender trucks have General Steel Castings frames with swing motion bolsters and are equalized. The multiple-wear rolled-steel wheels are 41 in. in diameter, mounted on axles of 6½ in. by 12 in. nominal journal sizes, fitted with SKF roller bearings. The brake rigging is the A. S. F. clasp type. There are two brake cylinders, mounted on the tender frame. The tenders are now fitted with Waugh-Gould draft gear No. 403 with Farlow 2-in. key type attachments and Type E swivel-butt couplers. The bed castings, however, are designed for the future application of Waugh rubber draft gears.

This tender design was first used on the L-3a locomotives built in 1940—It carries 42½ tons of coal

Roundtable:

Stop Abuse of Forged Parts

Education A Vital Factor

The advent of roller bearing equipment and alloy steels into the materials which constitute the modern locomotive has compelled the repair shops to institute a program of education among the supervision and shop forces. The expert handling of these new materials to insure the absence of nicking and burring while being repaired is and has been a matter of education, which must be followed religiously.

To cite an example, the radii on the edges of rods and motion work were being chipped by the use of a special chisel ground in the center to the correct radius. There were numerous failures of these parts, which could not be attributed to any particular reason. On careful inspection it was found that in chipping these edges there was being set up a series of minute fractures, which in time progressed to ultimate failure. By changing the method and grinding instead of chipping these failures were eliminated.

The use of soft vise jaws, soft hammers and careful filing and handling is also a contributing factor to the answer of fewer nicks and the avoidance of failures.

The publishing of all failures caused by abuses of this kind is an important factor in the educational program, which is the direct solution of this problem.—*W. E. Buck, Superintendent of Shops, N.Y.C.*

Better Inspection Needed

Railroad equipment maintenance repair work differs from the usual run of industrial work in that it is primarily concerned with repairs and reconditioning of material and parts that have been in service. The economic use of materials does not permit bringing the parts back to exact standards; consequently every labor operation must concern the removal of the minimum amount of materials in order to extend the life as much as possible. This very feature makes every workman to some extent an inspector of semi-supervisor. It further necessitates a relatively longer period of training and instructions for the new employees, all of which throws a greater responsibility on those classified as inspectors and supervisors. The inspectors will have to develop a surer knowledge and exercise a more positive judgment in the reporting of necessary work. This may require some further training to develop the inspector's judgment as to the things that are safe for service and those which are not. Some of these decisions, normally, were reserved entirely for the supervision, but inspectors should be trained to be of more positive assistance.

Machine operators engaged in the forming of, or the removal of, metal must be more careful than ever in the finishing operations so as to eliminate tool marks, sharp fillets, seams, laps and such minute defects as later develop into progressive fractures. Floor or bench men must be prohibited from trimming or cutting sheet metal liners on running gear by chisels; using the running gear as anvils for the straightening or the cutting of wires, cotters and the like. Similarly, the use of these parts for making ground connections by the autogenous welders must be discouraged.—*H. Courtney, Shop Superintendent, Pittsburgh & Lake Erie.*

Pertinent Suggestions

Repairs to our modern locomotives should be given more careful attention than is now being done. More care should be exercised in the machining of crank pins, driving axles, links, radius rods, eccentric cranks, eccentric rods, union links, combination levers, brake beams, brake beam hangers and the parts most subject to failure in the unusually severe road service that is new being encountered.

Fillets with long radii should be used and all tool marks should be finished or polished out of all machined surfaces. Too many machine operators use a high polish, yet do not remove all of the tool marks. Tool marks, even comparatively insignificant ones, are often the starting point of fractures which cause failures, and failures result in train delays.

In forging all motion work parts, axles, crank pins, and similar parts, a common failure is not to use enough time in the first slow heating of the billets. They should be properly and slowly heated before forging, but should not be forged at too low a temperature. After forging, the forging stresses should be removed before machining the parts. After the parts are machined the machining stresses should be removed before giving them the final heat treatment. A serious oversight with locomotive parts is that not enough time and care is exercised in the machining and heat treatment of these parts, and frequently not enough care is taken in the selection of the proper kind of material to be used.

Many railroad locomotive shops are not equipped with facilities for testing out the different types of steel and, therefore, a steel not suitable for the purpose is often used. Naturally it is of primary importance to know before a forging is started that the billet is of the proper composition for the service required. The testing laboratory, therefore, plays an important part in selection of locomotive repair material.—*E. J. Hausbach, Shop Superintendent, Wabash, Decatur, Ill.*

Inspection and Education

The protection necessary to insure against failure of highly stressed machined parts can be enhanced by two methods, namely, rigid inspection and education.

Shop inspection insures that the designs of the parts are faithfully carried out in their manufacture, and that a finish suitable to the importance of the part is applied. Inspection at engine terminals should reveal the presence of the various causes of failure nearly as soon as they occur. By causes of failure, I refer to nicks, bruises, arc or torch burns, etc. The quick removal of such defects by grinding the injured parts away, and providing in their place a smooth finished depression with suitable radii, will generally prevent the occurrence of a progressive fracture.

To secure an inspection which will locate these initial defects, it is necessary that the parts to be inspected be thoroughly cleaned by one of the several methods now in use on up-to-date railroads. A dirty, grease-coated part cannot be adequately inspected. A clean rod or part can be given close inspection in the time usually allotted for this work.

Education enters the picture when portions containing the fracture are removed from large parts, or entire small parts which have failed, or which have been discovered to be cracked by magnaflux inspection, are circulated among the various foremen responsible for their maintenance. The average employee is often skeptical of the claims that small nick or arc burn will eventually cause a complete fracture, but can usually be convinced that such claims are true when confronted with the actual parts, showing fracture lines starting at the point of injury and progressing from there into the part, until finally complete fracture occurs.

A few minutes by a gang foreman, in explaining the seriousness of small defects to each member of his gang, will serve to prevent defects caused through carelessness by men who do not realize the results of these apparently minor nicks. The employee should also be advised that immediate removal of the defect by the abovementioned methods will minimize the possibility of future failure.

A certain responsibility rests with the individual foreman to see that his men are supplied with the necessary wood blocks, soft hammers, etc., used by his gang in handling the parts concerned. Lack of proper equipment often results in careless handling practices, which otherwise would not occur.

Close attention to these suggestions will, I believe, contribute to the greater service now required of these highly stressed parts.—*T. J. Lyon, Superintendent Locomotive Shops, N.Y.C., Beech Grove, Ind.*

EDITORIALS

Tell Us How You Prevent Accidents

War conditions and manpower shortages have focused attention sharply upon handicaps which prevent us from achieving maximum production in industry and transportation. Preventable accidents stand out in distinct relief as one of the chief causes of loss of manpower. While the railroads were leaders in starting the safety first movement, their safety records in the mechanical department are not uniform or on the whole satisfactory. It is true that some mechanical departments have made remarkable records in accident prevention, but unfortunately others lag far behind. Please tell us out of your own experience how you think a better job can be done. Specific facts about how troublesome problems have been overcome and the records improved, will be particularly appreciated. Your letter must reach our New York Office as promptly as possible, and not later than August 15.

Facts vs. Slogans

Statements issuing from Washington indicate that there is dissatisfaction with the war production program—that May and June outputs of weapons important in the conduct of global warfare have not been up to the quotas. Even more than hints have been heard that the public is complacent—that it thinks the war is almost won and so is taking it easy. Specifically, absenteeism is pointed out as a cause of the slump—by inference the principal cause. So much concern is felt that a new slogan has been proposed to pep up the workers on Navy contracts.

This is not the first time the American people have been accused by officialdom in Washington of being complacent. If there is any truth in the charge, at least one cause is fairly obvious: that is, the extent to which the public is kidded with slogans and deprived of facts. A few facts might be helpful in the present situation.

Is absenteeism an adequate explanation of the failure to meet the quotas? There are signs that the inroads of the military forces on available manpower are actually beginning to embarrass essential industry. The want-ad pages of city newspapers throughout the country suggest that a desperate struggle is going on for many classes of skilled workers and supervisors. In view of the persistence of these ads is it inferring too much to assume that the response is not adequate to the needs?

This is the first total war in which the United States has been engaged. The utmost effort of the entire nation must be put forth if it is to be completed successfully and without unnecessary waste of life and other national resources. It is the first time we have faced the necessity of carefully balancing our use of every resource, both material and human. There is grave suspicion in the minds of many citizens that our national management of manpower is not based on an understanding of this situation—that the programs of the military establishment have been accepted without adequate consideration of their relationship to all other phases of the national war effort.

Evidences of strain in that respect are beginning to appear in the railroad industry. The report of the Railroad Retirement Board indicates that as of June 1 there were unfilled needs for over 73,000 persons. The largest number of unfilled vacancies—44,350—were in the maintenance of way and structures department, in which, no doubt, seasonal influences are involved. The next group, however, is maintenance of equipment and stores of over 19,000, which is not seasonal. While not yet alarming, the situation is getting critical.

It is important that the American people know the facts with respect to this situation because on their understanding of the facts will depend the character of their contribution to the nation's all-out warfare. Even if it is necessary that we build up our armed forces faster than they can be supported at present rates of output per man-hour, the additional desperate effort needed will not be forthcoming until public suspicion is replaced by public understanding.

What Is An Adequate Depreciation Rate?

Many shop engineers in both manufacturing and railway fields have accepted the idea that the only certain way in which shop equipment such as that in car and locomotive shops can be kept up-to-date is to set up a reserve fund—such as a reserve for depreciation—out of which new equipment is purchased periodically. No doubt the proponents of this idea will be sympathetic to the bill recently introduced (S. 931) by Senator Stewart of Tennessee, which would require the railroads to maintain in liquid form a fund for the replacement of depreciated property.

For years there has been a mild debate going on between those who accepted the retirement method of accounting and those who believe that the only logical method of charging off wear, tear and obsolescence is that of straight-line depreciation. For those who favor this latter method, there will be support in the recognition by the I. C. C. of the adaptability of this latter accounting method to present-day needs. An order, effective January 1, 1943, makes mandatory the application of composite annual rates as a basis of monthly charges to the appropriate depreciation accounts.

For sake of argument, it might be said that retirement accounting sets up a rather inflexible system that has operated in many instances as a handicap to the acquisition of new machine tools and shop equipment required to replace worn-out and obsolete units. Regardless of any handicaps of the retirement, or any other accounting system, the principal handicap to the acquisition of new shop tools and equipment has been the necessity on the part of mechanical officers and supervisors of justifying the installation of new and sometimes very expensive machinery where the rate of output or the potential hours of usage were too low to show an adequate return on the investment. Inasmuch as most roads require approximately 17 per cent return, there has been relatively little new shop equipment purchased in the railroad field for 10 to 15 years.

In spite of the Commission's order affecting straight-line depreciation, there still remains the problems of establishing equitable depreciation rates for machine tools and shop equipment. Under the order, rates set up by the Bureau of Valuation are to be used until such time as the carriers can assemble data and file tentative rates with the Commission.

The real problem in the establishment of depreciation rates with respect to railroad shop machine tools is the fact that the real life of such a unit of equipment must be measured in machine hours and not in months or years. In "normal" times, such as those immediately preceding the outbreak of the war, the actual total annual machine hours of service of the average machine in a railroad shop, on the basis of single-shift eight-hour days, would be so low that a relatively low depreciation rate could be justified. On the basis of such a low rate the ultimate life of the tool must of necessity spread out over a number of years. This, of course, took no cognizance of obsolescence in shop equipment with the result that, today, most of our shops are very much out of date as regards shop equipment.

On the other hand, when shops are operated at the rate they are being used today, with many tools being used on practically 24-hour shifts, it is obvious that a depreciation rate based upon a normal machine-hour usage would be entirely inadequate.

These points are mentioned to emphasize the necessity of making a thorough study of locomotive machining operations, not only because of the value of such a study in the establishment of proper depreciation rates but to be able to set up that which has always been badly needed—an intelligent program of shop equipment replacement.

We have always been suspicious that had the railroads had such a program, any controversy as to the relative merits of retirement and depreciation accounting would have had very little significance. After all, the ultimate objective is to keep our shop facilities in such physical condition as to be able to repair equipment at minimum shop cost.

Good Ideas As Helpful As Additional Manpower

This thought is not new but it is possibly being overlooked in some American railroad shops. Employee-suggestion arrangements and labor-management committees have been employed on a number of roads for many years and have contributed much to the development of better working conditions or improved methods of work performance. We call attention to these plans again because, with the ever-increasing difficulty in obtaining a sufficient number of skilled or semi-skilled employees, other factors must be more carefully considered in the light of their possibilities for more effectively utilizing the forces now available.

Nothing at the present time can contribute more to the number of man hours available for productive effort than the study of job methods. Other industries are finding this fact to be so true that financial rewards of substantial size are often made for relatively minor improvements in tool design, machine set-up, jig arrangements or work scheduling. Where the monetary incentive is not offered suggestions still pour from the employees where management makes it clear that the suggestions will receive thoughtful consideration. It is true of the American workman generally that adoption of a suggestion which he has made is a real personal satisfaction to him apart from any direct economic benefit.

In any tool room or machine shop there is always at least one, and usually more than one, employee who is known among his fellow workmen as a fellow who is

always tinkering, thinking and experimenting. Not all of his ideas work, or are profitably useful if they do work, but some of them prove adaptable to shop needs and are eventually employed. The purpose of the "shop-kinks" section of this and other technical publications is to pass on such ideas from practical men to others who might be able to use or to adapt them. Only a small percentage of them ever reach an editor's attention. Within each shop there may be some which never reach a foreman's attention for any one of a number of reasons. Perhaps the men are not encouraged to develop their ideas; perhaps the foreman is "too busy"; perhaps he wants to initiate all the ideas himself; perhaps sufficient credit is never given for ideas when adopted; perhaps no one has ever thought of encouraging them.

Whatever the reason, here is a potential source of productiveness in the shops of all railroads today. On some it is being made use of to a great extent, on most it could be more widely explored. The initiation of job instructor training and of job method training on most roads will help somewhat; the consideration of such training as a virtual source of manpower capacity will help to an even greater extent.

Preventive Maintenance

In the mind of the electrical man, the term "preventive maintenance" is apt to conjure up a picture of a megger being used to measure insulation resistance. In recent years, much attention has been drawn to the importance of keeping a record of insulation values on electrical equipment, since they indicate the degree of progressive deterioration and permit the making of minor repairs which prevent costly failures.

War requirements have greatly increased the need for preventive maintenance and it is being broadly applied. The proper procedure for lubricating a motor or a generator is common knowledge. It consists of using not too little and not too much of the right kind of lubricant. Close attention to these needs avoids both bearing and insulation failures and amounts to preventive maintenance.

A traction-motor commutator is one of the most vital parts of an electric or Diesel-electric locomotive. Its condition will show the skilled observer not only the condition of the motor but also faulty functioning of other equipment or improper operations of the locomotive. Similarly, frequent inspection of the end of the armature away from the commutator will avoid trouble. This is the hot end, since ventilating air is brought in over the commutator, and it is subject to the effects of loose bands which will allow coils to work in their slots. Attention given to this will prevent insulation failures.

Dirt is probably the worst enemy of electrical equipment. Thus cleanliness is a first rule in preventive maintenance. This applies with particular force to air conditioning apparatus. Here excessive accumulation of dirt mean insufficient air circulation, reduced capacity excessive head pressures and ultimately they lead to complete failure.

So simple a thing as a vee belt, representing important strategic material, is subject to preventive maintenance. If they are given proper tension, always kept in alignment on parallel shafts, never applied by forcing them over the pulleys and always used as matched sets, their life can be greatly extended. Assurance of proper matched sets can be had by using a shop-made device which permits measuring the length of a belt under operating tension.

Programmed maintenance of lighting systems is also an effective preventive measure. It involves regular inspection and cleaning of fixtures and the renewing of lamps on time schedules rather than waiting for one to burn out before sending a man out to replace it. Attention to proper socket voltage is also important, since lamps are no longer available in a great variety of voltage ratings.

The life of wire and cable is being extended by increasing circuit voltages and thereby reducing current values and also by the use of capacitors for improving the power factor. The net result is better regulation at lower overall cost.

The trend toward conservation is also being indicated by the development of new devices. An example of one of these is a hot journal alarm system now applied to Diesel-electric locomotives which warns the operator of a dangerous rise of temperature in any of the journal bearings on the locomotive.

One point to be noted in these trends is that a large part of the preventive maintenance work can be performed by unskilled labor, thus relieving the shortage of skilled workmen. Another is that with the cessation of the war, the railroads must continue to practice rigid economy and many of the good habits forced upon them by present circumstances can result in lasting benefit.

New Books

WORKING STRESSES. *By Joseph Marin. Published by the Rutgers University Press, New Brunswick, N. J. 42 pages, 5½ in. by 8 in., illustrated. Price, $1.*

The selection of the current working stress value for the design of a structure or a machine is one of the major considerations in obtaining a safe and economic construction. The major factors involved in this selection are those such as the reliability of the materials; exactness with which the loads are known; accuracy of the theory for computing the stress and certain factors of time such as corrosion, deterioration and creep. In this volume three loading conditions are analyzed, namely, static loads, fluctuating loads, and creep and discussed in detail, with appropriate diagrams to illustrate the discussion.

THE READER'S PAGE

110 Volts For Passenger Cars

To the Editor:

In the July issue of *Railway Mechanical Engineer*, W. S. H. Hamilton, equipment electrical engineer, New York Central System, takes exception to editorial comments on the merits of 110-volt systems which appeared in the May number. He makes such a strong case for 64 volts that some added support for 110-volt systems seems to be in order.

The statement made in the editorial that cars equipped with a 110-volt system do not require charging at the Jacksonville Terminal is correct. The 110-volt system is to some extent responsible for the elimination of yard charging in that batteries composed of a large number of small cells have much better ventilation and this improves their capacity to take a charge or a discharge.

With reference to the use of the higher voltage lamps, Mr. Hamilton calls attention to the fact that there are no 110 but only 115-volt lamps available. The 110 is of course a nominal rating. As a matter of fact we actually use lamps rated at 120 volts. We admit the lumen output of a 115-volt lamp is only 79 per cent of the lumen output of a 30-volt lamp, based on the 40-watt size. What happens with the 60-volt lamp that Mr. Hamilton is using?

When we first started out with the 110-volt system, we did expect some lamp theft. Very much to our surprise, this has not occurred, and even though we were losing them through theft and 50 per cent of them were stolen, the lamp cost still would just match the 30 and 60-volt lamp cost. We also thought when we first went into the 110-volt system that lamp life would be shorter than that of the 30-volt lamp. This has not worked out in practice. The frailer filament in the 115-volt lamp has three anchorages, while the 30-volt lamp has only one.

Concerning the lighting of cars from 110 volts or 220-volt, 3-phase standby power, I do not think the railroads will equip all their cars with transformers, as the need for lighting from standby power is infrequent. Actually 110-volt power is available practically everywhere there is 3-phase standby power or alternating current yard lighting. The 220-volt, 3-phase power or single-phase lighting current can be used for lighting 110-volt cars by having a balancing transformer across the 220-volts.

Mr. Hamilton questions the desirability of using a large number of battery cells with a small number of plates as compared with fewer cells having a larger number of plates in parallel. I think if he will consult some storage battery engineers, they will tell him that where a given amount of power is to be secured from batteries it is better to have the greatest number of cells that space will permit rather than have only a few very large cells.

We are in agreement with the statement that the reason for the adoption of a voltage higher than 32 is that the lower voltage cables and motor commutators are too large when used in connection with electro-mechanical air-conditioning equipment. That is one of the reasons we adopted the 110-volt system and did not stop at 64 volts. The statement that the reduction in size of wiring in going from 64 to 110 volts is not anywhere near as important an item as that secured in going from 32 to 64 volts is not understood. In going from 32 to 64 volts the wire size can be reduced 50 per cent. In going from 32 to 110 volts the wire size can be reduced approximately 75 per cent.

The most outstanding advantage of the 110-volt system is that it permitted us to rebuild 4-kw., 40-volt, Gould and U. S. L. generators into 150-volt, 20-kw. generators, and convert 2-kw., 40-volt, U. S. L. generators into 10-hp., 125-volt compressor motors. The rebuilding of the old 40-volt equipments effected about $1,000 saving per car in the application of air-conditioning equipment.

I think all concerned can see that Mr. Hamilton took a step in the right direction when he changed from 32 to 64 volts. We think that he would have been better off had he taken two steps in the same direction.

C. P. Taylor,
Electrical engineer,
Norfolk & Western Railway Company,
Roanoke, Va.

Possibilities of Plastics

To the Editor:

The General Electric is a large producer of plastics and their trade name is "Textolite". We used a certain amount of plastics when we built "The Southerner" and "The Tennessean" streamlined trains. All the window sills were covered with Westinghouse plastic, known as "Micarta". We also used other plastics for table tops, mouldings and miscellaneous furnishings and decorations.

I checked this matter with one of the research engineers of the General Electric and as far as I can discover at this time, aside from decorative effects and miscellaneous fittings that would have passenger appeal in passenger-train cars, we have not reached the point where the industries are in a position to furnish plastics in volume enough to take the place of steel sheets, shapes, plates and bars in freight car construction, or in steam or Diesel locomotive construction, especially with the heavy poundage of plastics flowing into the materiel of war.

What the future will bring in the way of lightweight construction in passenger and freight service in the elimination of hauling of such large dead loads as we are now hauling to move a ton of revenue freight, I am not in a position to predict, but I think it would be safe to say that the trend will be in that direction and there will certainly be great competition between the various metals, as well as between the plastics and the metals, when peace comes once again.

J. M. Plaskitt,
Mechanical Engineer,
Southern Railway System

With the Car Foremen and Inspectors

Cleaning Tray For Fit-Up Bolts

Fit-up bolts, nuts, washers and key bolts are speedily recovered for use on the cleaning tray illustrated. The tray is in use at the Dunmore, Pa., shops of the Erie and consists of a perforated steel plate with flanged sides mounted on legs about 14 in. in height. Shop

Cleaning tray for fit-up bolts

sweepers collect all such materials in their regular cleaning and pour the accumulation of dirt, scale and reusable materials onto the cleaning tray. This is worked with a hoe until all dirt and scale has dropped through the holes in the plate. The cleaned parts are then sorted into containers for re-use. This method has been found to be much faster and more convenient than the former practice of having laborers pick up these small parts individually at the riveting locations.

Plywood Easily Handled In Railway Car Construction*

By E. L. Krietemier

The use of plywood in building and repairing refrigerator cars indicates some distinct advantages in handling and storing, as compared with handling and storing tongue-and-groove lumber.

We are constantly confronted with the proper storage of such items as siding, lining, flooring, etc., which must be given full protection from the elements. Since available storage space is limited it is necessary to utilize all available space to the best advantage. Plywood has reduced the amount of floor space required.

The difference between the size of tongue-and-groove lumber and the actual covered space on a car results in a loss of storage space. The standard 3¼-in. face tongue-and-groove lumber has the additional width of the tongue, or about ¼ in., making the overall measurement of the board 3½ in., so the actual covered space on the car of 3¼ in. results in a loss of approximately 7 per cent in storage space. The use of plywood avoids this.

To illustrate let me cite an actual case of storage space on roof sheathing used on refrigerator cars: A sufficient amount of 1-ft. by 4-ft. by 18-ft. tongue-and-groove roof sheathing for 50 refrigerator cars requires a space 12 ft. wide and 18 ft. long, or 216 sq. ft., piled 8 ft. high. A sufficient amount of plywood for the same purpose requires a space 4 ft. wide and 12 ft., 6 in. long, or 50 sq. ft., piled 7 ft. high, resulting in a saving of 166 sq. ft. of floor space.

Considering that a like saving is realized on siding, floor, lining, ceiling, insulation, and in our particular cars, drain floors, it is safe to assume that the saving in floor space is at least 75 per cent.

Marked Difference in Handling Cost

Tongue and groove lumber is available in 3¼ and 5¼-in. face and in lengths of 8, 10, 12 ft. and upwards, in multiples of 2 ft. This makes it necessary to order in lengths with a minimum offal, and then cover a given space with as many 3¼ or 5¼-in. boards as are necessary. In comparison to the many pieces of tongue-and-groove lumber, plywood is ordered in large sheets, in most instances 4 ft. by 8 ft., with smaller pieces to fill out. This creates a considerable saving in handling, not only at the time of receipt of the material, but also in delivering to the car on which it is to be used. In addition, the handling to the mill to cut to size and square is entirely eliminated, as the plywood is ordered to the exact sizes required.

A more exact picture of the difference in the handling of tongue-and-groove lumber and plywood is shown in our operations on drain floors. In the application of one drain floor we use 73 pieces of 1 by 4 by 18-ft. lining, which is cut into 292 pieces, 4 ft. 1 in. long. After this material is unloaded from the car in which it is received, it is placed on the lumber pile. As required, these 73 pieces are removed from the lumber pile, loaded on a lumber truck and delivered to the mill. They are then removed from the lumber truck, cut into 292 pieces of 4 ft. by 1 in. lengths, replaced on the lumber truck and delivered to the car. These 292 pieces are then treated with a waterproofing compound on both the tongue and groove, a linear distance of 292 pieces by 4 ft., 1 in. by 2 sides, or a total of 2,380 linear feet that must be waterproofed. It is then necessary for the carpenters again to handle these 292 pieces in applying to the car.

* Abstract of a paper presented at the March 16 meeting of the Car Department Association of St. Louis. The author is storekeeper of the St. Louis Refrigerator Car Company.

My purpose in mentioning these 292 pieces so often has been to show the wide disparity in comparison to plywood. There are only 12 pieces of 4-ft. by 8-ft. plywood required for this drain floor, requiring the handling of only 12 pieces from the car in which it is received to the stock pile. As there is no billing whatever required, all labor involved in removal from the stock pile, loading on a lumber truck, delivering to the mill, milling and reloading on the lumber truck is eliminated. In waterproofing the edges on plywood, there is a linear distance of only 12 pieces by 4 ft. by 2 edges, or a total of 96 linear ft. involved. In the actual application to the car the carpenters also handle only 12 pieces.

Savings in Application Cost

Similar savings are realized on the bottom floor, where 10 pieces of plywood are used in place of 90 pieces of tongue-and-groove flooring; on siding where 20 pieces of plywood are used in place of 260 pieces of tongue-and-groove; on inside lining, where 36 pieces of plywood are used in place of 98 pieces of tongue-and-groove; on the ceiling, where 12 pieces of plywood are used in place of 72 pieces of tongue-and-groove, and on the roof sheathing where 12 pieces of plywood are used in place of 72 pieces of tongue-and-groove.

Plywood panels stacked in a railway shop ready for use in rebuilding freight cars

There is also a saving in labor in the application of plywood in comparison with tongue-and-groove lumber. If you will visualize the application of one large sheet of plywood and then the many small pieces of tongue-and-groove lumber, the savings involved are obvious. The illustration on drain floors holds true in the same proportion with respect to the application to the car, as well as on the bottom floor, siding, inside lining, ceiling, roof sheathing and all insulation.

It is worth while to mention the fact that on the first lot of new cars which we constructed entirely of plywood, we used approximately 19 per cent less nails than on a similar car constructed of tongue-and-groove lumber.

Again, after discussing the savings in application cost, the additional savings in handling cost should be considered in the light of critical man hours saved.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

189—*Q.—Describe the action when speed reduces to approximately 20 m. p. h.* A.—Relay *2-L* drops out, thus opening its contact *2-LA*. The opening of this contact removes the short circuit around relay *2-L*, allowing it to be energized. The closing of contact *6-D* energizes the low speed (L) *F.S. 1864* relay magnet, thus developing 40 per cent maximum braking force.

190—*Q.—What happens in the event of an open wire from the generator or battery?* A.—All *F.S. 1864* relay magnets are de-energized.

191—*Q.—In this event what braking force is developed?* A.—Sixty per cent maximum braking force, or 150 per cent braking ratio, the same as is used on conventional cars without speed governor control.

192—*Q.—What is used across the contacts of the relays which control the FS-1864 magnets? Why is this necessary and when?* A.—Arc suppressors are used to protect the contacts of the relays which control the *FS-1864* magnets, these contacts being on relays *6* and *6-M*. This is necessary to protect the contacts of these relays when the speed governor equipment is used to handle the FS-1864 relay magnets throughout the train. If individual speed governors are used on each car, the arc suppressor is not necessary.

193—*Q.—Of what do the arc suppressors consist?* A.—Resistors *13* and condensers *14*, shown in Fig. 14. Condensers are connected across the contacts of relays *6* and *6M* and are used to extinguish the arc caused by the circuit being opened. The resistors are connected across the magnets and serve to limit the high voltage induced when the magnet circuit is opened.

194—*Q.—What does the speed governor afford protection against?* A.—The development of braking force in excess of that which is practical for varying speed.

195—*Q.—How is the speed governor equipment tested?* A.—By means of a test set furnished by the manufacturer.

Installation and Maintenance of Axle Generators

196—*Q.—With how many types of drives are the generators provided and what are they?* A.—Two types; *A* and *B*, shown in Fig. 10A.

197—*Q.—What does the type A consist of?* A.—A splined drive shaft (Ref. 5—Fig. 10), engaging a spline bushing centered in the end of the axle and is used chiefly on bearings having axle thrust plates.

198—*Q.—What does the type B drive consist of?* A.—The type B drive is used in journal boxes not having axle thrust plates and consists of a crank arm and coupling plate (Ref. 13—Fig. 10), fastened to the armature shaft and two driving studs (Ref. 11—Fig. 10A), threaded in the end of the axle and engaging in slots in the coupling plate.

199—*Q.—Describe the method of installation with the type A drive.* A.—The spline shaft (Ref. 5—Fig. 10), for the type *A* drive has been assembled at the factory to the generator with which it is shipped and the thickness of the laminated shim (Ref. 3—Fig. 10) has been adjusted for the proper drive shaft fit. It is important that the serial number marked on the drive shaft corresponds with the number of the generator to which it is assembled. To assemble the shaft to the generator, first remove and discard the lock nut from the end of the armature shaft. Engage the tongue of the drive shaft in the slot in the end of the armature and thread the coupling cap (Ref. 4—Fig. 10) securely in place and lock by means of the lock washer (Ref. 2—Fig. 10). Securely holding the splined end of the drive shaft during this operation will prevent rotation of the armature and permit proper tightening of the cap. After assembly, the drive shaft should be free but without end play. If end play is present check the coupling cap to see that it has been drawn up tight. If this has been properly done and end play still exists remove the coupling cap and drive shaft and adjust the thickness of the laminated shim washer by peeling off a number of shim thicknesses sufficient to give the proper fit as described above. The splined plug in the end will have been installed by the axle manufacturer and requires no adjustment other than to see that the spline members engage correctly.

200—*Q.—Describe the installation of the type B drive.* *A.*—Generators using the type *B* drive are shipped from the factory with the drive completely assembled and for installation require only the mounting of driving studs on the end of the axle. Depending on the individual installation the drive studs may be mounted directly in the end of the axle or on an intermediate mounting plate bolting to the axle or the axle bearing locking means. Several arrangements of drive studs are shown in Fig. 10A. Detailed information regarding mounting is given on the drawing for the individual application and this must be closely followed in making the installation. Where the application requires drive stud spacing other than 4 in., it is important to check the coupling ring (Ref. 13—Fig. 10) to ascertain that it is suitable for the drive stud spacing being used. So that this may be readily determined, coupling rings usable with stud spacing from 3½ in. to 4 in. are marked with the painted number 3 or stamped 3½-4.

* * *

THE "TROUBLE-SHOOTER" FOR CORRECTING THREADING ILLS

WHEN THREADS LOOK LIKE THESE . . .	HAND THREADING		MACHINE THREADING	
	LOOK FOR . . .	CURES . . .	LOOK FOR . . .	CURES . . .
	DULL CHASERS (Check by inspection)	SHARPEN	DULL CHASERS	SHARPEN
	INSUFFICIENT LUBRICATION (This not only makes poor threads but damages chasers.)	USE PLENTY OF GOOD OIL (Sulfur base threading oil plus little lard oil gives good results.)	INSUFFICIENT LUBRICATION	FLOOD WITH GOOD OIL (Sulfur base plus little lard oil gives good results.)
	IMPROPER LEAD SHAPE (Usually due to improper grinding.)	GRIND PROPERLY	IMPROPER LEAD SHAPE	GRIND PROPERLY
	EXCESSIVE OR INSUFFICIENT LEAD CUTTING ANGLE	GRIND TO CORRECT ANGLE	IMPROPER LEAD CUTTING ANGLE	REGRIND TO PROPER ANGLE
	BROKEN TOOTH IN CHASER	GRIND OUT ENTIRE TOOTH	BROKEN TOOTH IN CHASER	GRIND OUT ENTIRE TOOTH
	CHASERS NOT SET TO FORM TRUE CUTTING CIRCLE	CLEAN SLOTS—SET CHASERS TO TRUE CUTTING CIRCLE —GRIND CHASERS TO MAKE THEM OF UNIFORM LENGTH	CHASERS NOT SET TO FORM TRUE CUTTING CIRCLE	CORRECT SETTING
	IMPROPER LEAD OF CHASER	REGRIND LEAD	IMPROPER LEAD OF CHASER	REGRIND LEAD
	CHASERS NOT TRACKING PROPERLY	KEEP SLOTS CLEAN	CHASERS NOT TRACKING PROPERLY	KEEP SLOTS CLEAN
	CHASERS NOT SET IN DUE ROTATION	CORRECT SETTING	CHASERS NOT SET IN DUE ROTATION	CORRECT SETTING
			CARRIAGE TRAVEL RETARDED	REPAIR CARRIAGE
	DIE OR CHASERS NOT SET TRUE	CENTER DIE OR CHASERS	LOOSE CHASERS (Play in slot lets chasers tilt, increasing clearance.)	NEW DIE HEAD
	THUMB SCREWS NOT TIGHT	TIGHTEN SCREWS WITH WRENCH	WORN CAM IN DIE HEAD (Check lost motion due to worn cam.)	NEW DIE HEAD
	WORN-OUT LEAD SCREWS	GET NEW DIE STOCK		
	CUTTINGS OR DIRT IN CHASER SLOTS	KEEP SLOTS ALWAYS CLEAN		
	PIPE ENDS NOT SQUARE (Die starts on same angle as end cut, and threads diagonally. This trouble often wrongly blamed on "out-of-round" pipe.)	CUT PIPE END SQUARE TO AXIS OF PIPE AND RE-THREAD	MISALIGNMENT OF DIE AND CHUCK	CHECK AND RE-ALIGN

DO'S AND DON'TS IN THREADING

Don't try to work with dull tools. No craftsman can do good work with poor equipment.

Don't put new or sharpened chasers in a worn stock, and expect to get first-class results. After the stock is worn out, it should be discarded.

Don't skimp on oil—either in quantity or quality. Good oil pays dividends in better work, and longer die life.

Don't try to use a set of chasers after long use or abuse has impaired its precision. Discarding worn out chasers is sound economy.

Don't forget to accurately center the die and tighten the thumb screws *WITH A WRENCH* in hand threading, and don't forget to line up the pipe properly in the grips in machine threading.

Be sure to clean slots of all dirt, gummy oil, chips, etc., when you change chasers. Keeping tools clean lengthens their life.

Be sure, when the chasers are reground, that it is done by someone who knows how, or who will accurately follow directions. Wrong grinding can ruin chasers, spoiling a multitude of threads.

Be sure that the pipe ends are cut off square and true. Give the die a fair chance, so it can start on straight.

When trouble occurs, check up your *equipment carefully.* It may be that the trouble is something that a little adjustment will fix. In any case, the difficulty can be corrected with a minimum of cost and lost time.

And finally, cut the thread long enough to engage fully the threads in the fitting. A thread like the one illustrated below is too short to resist mechanical forces caused by expansion and contraction, vibration, and so forth.

★ ★ ★ **BYERS WROUGHT IRON PIPE** *has superior thread-ability* ★ ★ ★

Industry is cooperating with shop management in the preparation of informative material to aid in training workers—The chart shown is an example and is one of four prepared by the A. M. Byers Co., Pittsburgh, Pa.—Similar charts are available to inquirers on the subjects of pipe bending, plate bending, and flame cutting and welding—Booklets on all subjects covered by the charts are also being furnished for use in instruction courses

Jig for Use in Welding Center Plates

Scrap material, available around any car shop, can be used to build a jig which will facilitate the welding of cracked center plates. The base of the jig can be made from a scrapped brake wheel and other portions made from scrap plate or bar iron. A joint is provided to allow a 180 deg. movement of the table plate in the vertical plane and an additional joint allows full turning of the jig table through 360 deg. without reference to its position vertically. End bar clamps fasten the center plates firmly in position on the working table and an additional clamp through the pin opening aids in holding the center plate firmly against the table surface and helps to prevent any distortion which might result from the welding heat.

Scrap material can be used to construct a jig which permits positioned welding on center plates

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Home Shop Movement Authorized On Owner's Responsibility Damage

Under date of August 2, 1938, the Reading Company advised the North American Car Corporation that it was holding NADX car No. 1022 at Hershey, Pa., with defective center sills and requested disposition and routing. The North American Car Corporation on August 4, 1938, asked for full information as to the nature and extent of the damage to the car; also the responsibility therefor. On August 9, 1938, the Reading Company advised the owner that center sills were buckled 2½ in. at the center of the car, owner's responsibility, and recommended authorization to forward the car to home shop for repairs, the car to be handled on rear end of train to prevent further damage. Authority was given and the car moved via the Reading, Pennsylvania and Chicago & North Western to Baraboo, Wis., arriving there on September 7, 1938. Subsequent joint inspection revealed that the center channels and side sills were bent 2⅝ in. On October 7, 1938, the Reading Company was requested to assume responsibility and forward defect cards. Other correspondence revealed that the Reading's car foreman and car inspector had made actual measurements with a straight edge and found the sills to be buckled 2⅜ in. with the side sills deflected downward 3 in. The claimant company relied on this discrepancy in the figures given in correspondence and on the fact that the construction of the car made it impossible to take accurate measurements on the center sill to establish handling line responsibility. When the Reading refused to issue defect cards it wrote that it was taking up the matter of issuing a defect card with the Susquehanna & New York, which road had delivered the car to the Reading. This fact was relied on by the claimant to establish that the sills must have been buckled in excess of 2½ in. when the car passed interchange. The claimant also questioned the Reading's action in reporting the car, although Rule 44 does not so require when damage is not over 2½ in. The Reading pointed out that its action was within the spirit of the rules and gave the car owner an opportunity to examine the car if it was not satisfied as to responsibility before ordering the car home. Failure to do so was construed

* * *

Special jig used in a car builder's shop for making box car doors

as acceptance of the statement as to owner's responsibility. The history of the car showed that note was made of sills bent by the Susquehanna & New York when it received the car from the Lehigh Valley, that the Reading made a similar record when it received the car and that the Pennsylvania accepted it for home bound movement without requesting a defect card. The Reading contended that the defect was a progressive one and that it should not be penalized for the 3-in. deflection noted at Baraboo, Wis., after the car had journeyed about 1,000 miles with a 2⅜-in. deflection.

In a decision rendered November 6, 1941, the Arbitration Committee ruled against the complainant stating: "When the car owner ordered the car home for repairs without having the car inspected and without questioning the Reading's statement that the sills were not bent in excess of 2½ in., it is considered as being equivalent to acceptance of statement of the handling line. The principle of Rule 45 applies. The contention of the Western Refrigerator Line Company is not sustained."—*Case No. 1787, Western Refrigerator Line Company vs. Reading.*

Claim Against Trunk Line For Car Damaged on Switching Line

The Hoosac Tunnel & Wilmington received SHPX car No. 10817 on September 16, 1938, and spotted it on a plant siding. A flood occurred and the car was washed into the river along the railroad. The trucks lodged in the bank and later served as rip-rap in rebuilding operations. The tank and underframe were washed down the river and piled up with other cars along tracks of the Boston & Maine. In salvage operations the latter company assumed the car to be one being handled by it at the time of the flood and reported its destruction to the owner under Rule 112 asking for the depreciated value. Later the true circumstances were discovered and reported to the car owner. The B. & M. disclaimed responsibility because the car had been delivered as billed and was in possession of the H. T. & W. at the time of the flood. The car owner relied on Rule 113 as establishing the responsibilty with the B. & M., while that road's interpretation of Paragraph 2, Rule 113, relieved it of responsibility in view of the car in question being a private car not "owned or controlled by a railway company."

On April 23, 1942, the Arbitration Committee found in favor of the railroad, saying: "The owner of the private line car in question admits the car was in possession of the Hoosac Tunnel & Wlmington at the time of its destruction. Under the provisions of Rule 113 in effect at that time the Boston & Maine is not responsible."—*Case No. 1788, Boston & Maine versus Shippers' Car Line Corp.*

Precooling Air-Conditioned Cars From Terminal Stand-By Facilities

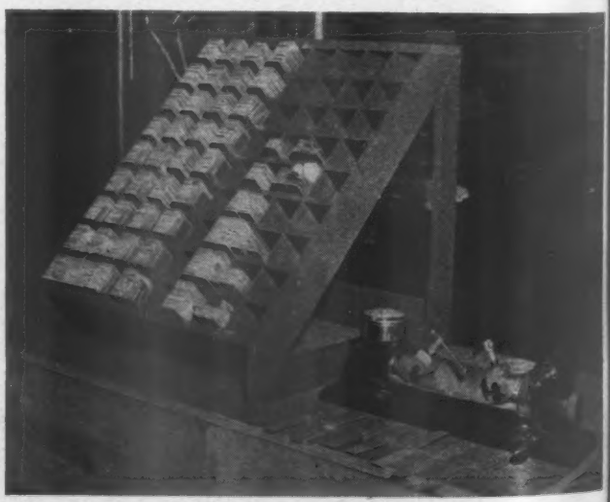
The New York, New Haven & Hartford and the Boston & Maine operate passenger equipment of both lines' ownership in through service between points on the two roads. The cars are equipped with electro-mechanical air-conditioning systems and are precooled at Grand Central Terminal before departure from New York. The New Haven cars are provided with receptacles to permit precooling with current from an outside source; the B. & M. cars are not so equipped and it is necessary to use current from the car battery. The B. & M. pays the entire cost for charging batteries on its cars when this work is performed by the New Haven. In addition to this charge the New Haven also billed the B. & M. for its proportionate share of the current cost of precooling receptacle-equipped cars of New Haven ownership. The B. & M. refused this billing on the ground that New Haven cars could be precooled by battery current and that, in effect, the charge for outside current to the B. & M. represented a proportionate share of the cost of recharging New Haven car batteries, which under P. C. Rule 9, Paragraph 3, is at owner's expense. The New Haven contended that, under the same rule, the charge was a proper line service expense.

In a decision rendered November 13, 1942, the Arbitration Committee ruled that: "The cost of precooling cars by electric current furnished from stand-by facilities is a line service expense. The roads involved in the line should agree on the cost of such service and each should assume its mileage proportion of such cost. The contention of the New York, New Haven & Hartford is sustained."—*Case No. 1789, Boston & Maine versus New York, New Haven & Hartford.*

Testing Spot Welds For Shear Strength

A quick, simple method for shop testing the strength and soundness of spot welds has been developed in the East Springfield, Mass., plant of the Westinghouse Electric & Manufacturing Company. Spot welding is usually tested by "pulling a button" but this only tells if the material is actually welded, failing to give any measure of strength or soundness of weld.

A small shear-testing machine is now used to make a thorough test. When an inspector desires to make such a test he takes two standard test pieces, cleans the surfaces and makes the weld by overlapping the two pieces. The welded specimen is then clamped in the machine and subjected to shear. The force applied in pounds is shown by a gage on the machine. A prepared chart shows the minimum strength required for the various thicknesses and types of material.



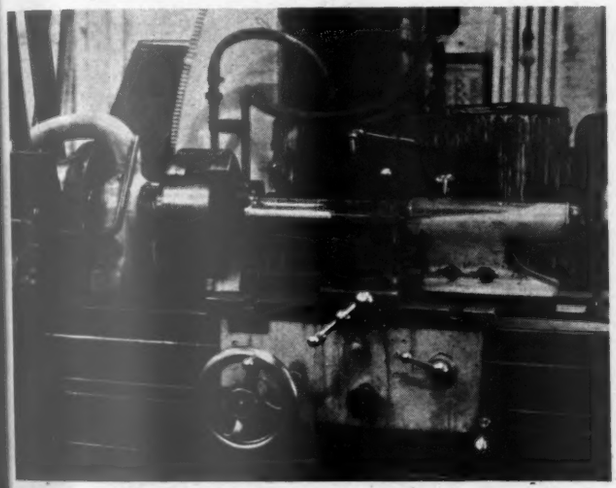
Shear testing machine and rack for test pieces

Advantages gained from the use of the shear-testing machine are: (a) aids in control of quality by giving a quantitative value of the strength of the weld; (b) serves as a quick check on setup of spot welder; (c) compact and simple to operate; and (d) permits tests to be made by operator or floor inspector instead of a laboratory technician.

IN THE BACK SHOP AND ENGINEHOUSE

Pin Turning on a Production Basis

An old engine lathe has been converted into a single-purpose machine at the Meadville, Pa., shops of the Erie. Faced with a demand for pins of the many various sizes required for repair purposes, this production plant now is able to furnish all that are needed without the necessity of setting up work on any of the more modern tools



An old engine lathe, an air chuck, a turret lathe tool post and Carboloy tools make an efficient pin turning unit

in the shop. An air chuck was mounted on the lathe and a Carboloy tool in a turret lathe tool holder is used for machining operations on the forgings received from the blacksmith shop. The lathe is operated at 240 r. p. m. with a feed of $\frac{1}{32}$ in.

Ten Commandments for Diesel Maintenance*

1. Thou shalt keep thine engine clean and in adjustment that thy life in its company shall be long and that the owner shall increase thy pay.

2. Know thine engine and all its parts and functions, else thou shalt be in some unholy spot.

3. Be not wise in thine own conceit. Remember the factory instructions and keep them holy, lest repairs be thine undoing.

4. Be not loose in thy jaw hinges for no man knoweth all about Diesels. The truly wise absorbeth much knowledge and exulteth little, and he who so doeth shall gain repute among his fellows and favors among his superiors.

5. For all things in this life that thou desireth thou shalt also pay plenty and for the wisdom of experience, no less. Advice from the multitudes costeth nothing and is usually worth just that.

6. In the books thou mayest read what to do and when, but only the voice of experience may tell thee why and how, else thy reading of what and when shall but plague thee with smoke.

7. God maketh the earth to rotate endlessly without bearings, or oil, but not thy Diesel.

8. Curse not thine engine when it turneth not. Curse rather thine own stupidity.

9. Steam engines and gas engines may long turn over though sloppy; a Diesel not so. With gages and mikes be thou ever busy.

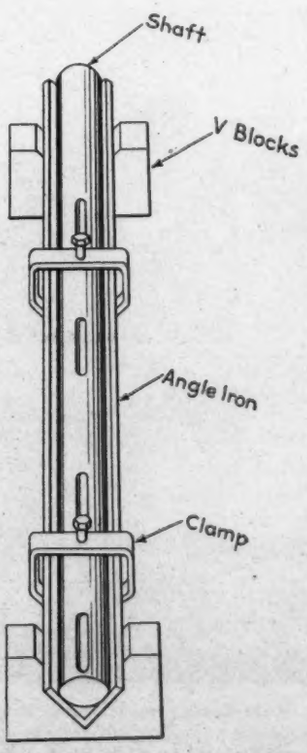
10. The eternal eye watcheth universal operations, but thou shalt not rely upon it as to thy Diesel. Thine own vigilance is the price thou payest for thy job.

* Prepared by W. C. Conder, chief machinist's mate, U. S. S. Trapnal No. 125 U. S. A., and widely used and distributed by the Electro-Motive Division, General Motors Corporation.

Small Machine Gives Large Spliner Results

A simple angle iron fixture developed at General Electric's Schenectady Works overcomes the problem of misalignment in cutting the keyways in a 3-in. diameter, 6-ft. long cam shaft, and permits a small machine to do a job ordinarily requiring a large spliner.

Previously, even with the utmost care, the operator



Accurate machining of keyways is assured by the use of this fixture

was unable to machine the keyways so that they did not need correction. Most of the error was caused by the fact that only one or two keyways could be cut with one setup.

The angle iron fixture which eliminated these difficulties was planed on its four surfaces, and clamps were made for holding the shaft in place in the angle. Two keyways are cut, and then the shaft and fixture moved along in the vee blocks to the next setting. With the work done while the shaft is held in the fixture, the keyways are in line and remain that way after the shaft is straightened.

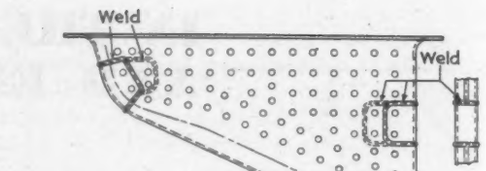
Questions and Answers On Welding Practices

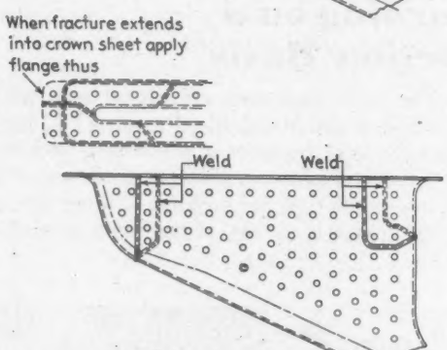
(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Welding Cracked Thermic Syphons

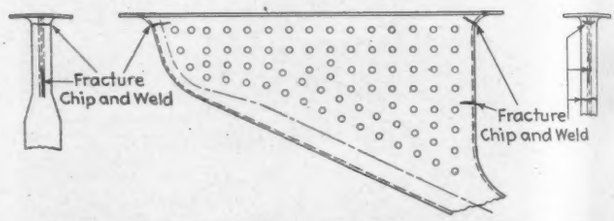
Q.—What methods are used for repairing cracks in the front or back of thermic syphons? These cracks have developed in the semi-circular ends of the syphon under the crown sheet.—E. F. D.

A.—Fractures in the front or back of thermic syphons are repaired by chipping out the fracture and then welding. The procedure is shown in the illustrations.





Welded patches may be needed for some syphon repairs—Locations where patches are required should be properly prepared before welding is begun



Welding alone will usually be satisfactory in repairing cracks in syphons

* * *

Courtesy of the Reading-Jersey Central Magazine

Not all the jeeps are in the army

Here is one developed by F. L. Giehl at the St. Clair (Pa.) enginehouse of the Reading. An Elwell-Parker crane truck is mounted on a four-wheel standard gauge truck. Used for loading, unloading and handling materials. The power take-off of the truck propels the car and if the truck crane is needed for delivering material in the enginehouse it is removed from the car by a ramp and then goes to work as an ordinary crane truck.

elding Piston Rod Nuts

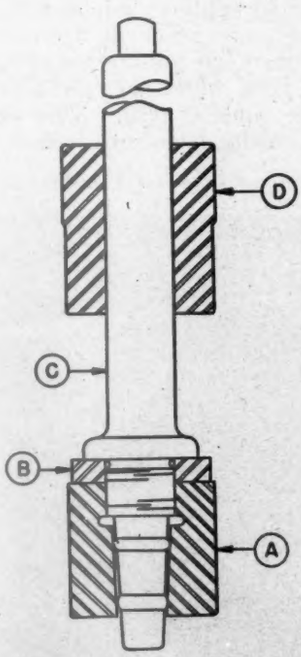
Q.—We are having trouble with loose piston followers. Do u know of any method whereby these may be kept tight?

A.—The following will be found to be a satisfactory ethod of correcting this trouble. The bull ring must e removed before the method is used. Presuming that e taper of the rod is the usual ¾ in. in 1 ft., the new iston rod is turned and tried until the follower goes to the fit to a distance of 5/16 in. from the shoulder. he rod and follower are then taken to the wheel ress and the press arranged so that pressure may be erted on the crosshead end of the rod. The follower heated thoroughly and while hot slipped quickly onto e fit. The assembly while still hot is lifted into the ress and a pressure of about 50 tons is applied to hold e follower and prevent it from backing off the fit as cools. When the piece is cool enough to handle the it is applied and tightened with a sledge and handle t. The rod and follower are then up-ended and a avy bead of coated rod welded around the junction the rod and nut. Chamfering the rod and nut before plication aids in getting depth and penetration in e weld.

izing Reamer or Restricted Locations

*By Henry Bernadt**

repetitive production tool devised at General Electric's chenectady Works quickly and accurately reams holes restricted places that are difficult to reach with scrap-



Sizing reamer for holes in restricted locations

n. The tool is essentially an expansion reamer, and e drawing shows the unit set up for operation.

When it is set up for production, the unit is first dis-sembled, an operation that reduces the diameter about 0.002 in. The reamer *A* is inserted in the hole to be finished, and tightened against a washer *B* by a twist of the arbor *C*. This expands the tool to the proper diameter and reams the hole to the correct tolerance in one turn. Part *D* is a guide member.

Cutter wear is taken care of by decreasing the thickness of the washer. This permits the taper portion of the arbor to further enter the cutter. A 0.001-in. reduction of the washer thickness will expand the reamer 0.0001 in.

* A methods man, General Electric Company.

Locomotive Boiler Questions and Answers

By George M. Davies

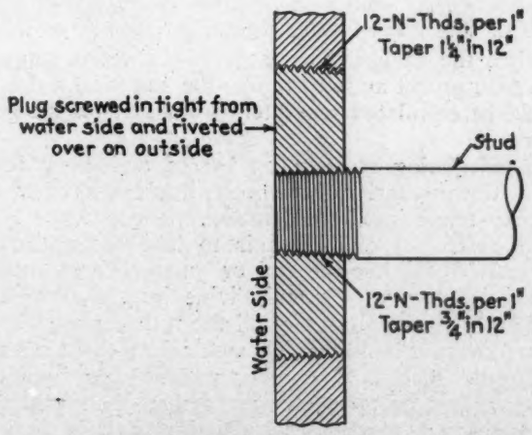
(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Using Oversize Studs

Q.—The feed water pump brackets on our 2-8-2 type locomotives were originally studded to the boiler with 1⅛-in. studs. They have been replaced several times, the stud diameter being 1⅜ in. Is it satisfactory to increase this diameter to 1½ in. on the next installation of studs?—H. E. E.

A.—It is satisfactory to use 1½ in. studs provided there are no cracks running from the stud holes, and if the efficiency between the stud holes does not fall below the efficiency of the longitudinal seam of the shell course involved.

General practice, however, is to limit the size of the stud renewals to 1⅜ in. diameter. The enlarged stud hole is then drilled out and a plug of suitable diameter applied, and the stud is restored to its original diameter.


12-N-Thds. per 1"
Taper 1¼" in 12"
Plug screwed in tight from water side and riveted over on outside
Stud
Water Side
12-N-Thds. per 1"
Taper ¾" in 12"

Preferred method of applying new studs in oversize holes

The diameter of the plug which can be applied before reinforcing is necessary is governed by the following rules:

It is not necessary to reinforce holes up to 3¼ in. in diameter, except injector check and blow-off cock holes.

Holes over 3¼ in. in diameter, the diameter of which

exceeds 4½ times the thickness of the plate, should be reinforced.

Holes over 3¼ in. in diameter, the diameter of which does not exceed 4½ times the thickness of the plate, need not be reinforced.

When there are other holes near the oversize stud hole which require a plug, or in the event that there are two or more oversize stud holes in one particular zone which require plugs, it will be necessary to calculate the efficiency in order to ascertain whether or not the holes can be plugged.

At no time should the diameter of the stud hole in the plug exceed a diameter by which the wall thickness of the plug around the stud hole is reduced below the thickness of the plate plus ⅛ in.

At no time should the efficiency of the plate between the plugs be less than the efficiency of the longitudinal seam of the shell course involved.

Calculating Boiler Braces

Q.—Will you kindly publish a set of rules for calculating locomotive boiler braces of both the rod and the gusset type? —F. E. R.

A.—The area of the backhead or front tube sheet to be stayed shall be the area enclosed by lines drawn 2 in. from the outside of the tubes or the center of a row of stays and at a distance D from the shell or wrapper sheet.

The area of the dry pipe holes in the front tube sheet should be omitted from the area as obtained above as it is assumed that this area is supported by dry pipe fastenings and the superheater header.

The valve of D used may be taken as the larger of the following values:

D = The outer radius of the flange, not exceeding eight times the thickness of the backhead or front tube sheet.

$$D = \frac{5 \times T}{P}$$

where

D = Unstayed distance from the shell or wrapper sheet, in.

T = Thickness of backhead or front tube sheet, sixteenths of in.

P = Maximum allowable working pressure, lb. per sq. in.

When the backhead or front tube sheet is supported with both gusset and rod braces the stress on rod braces should be calculated separately from that on the gusset braces.

In calculating stresses on braces and their attachments, the angularity of the brace, if in excess of 15 deg., must be taken into consideration. The practice in calculating stresses on braces is to take the entire area supported by either the rod or gusset braces, multiply by the boiler pressure and divide by the sum of the least cross sectional area of all the rod or gusset braces. This method should be followed when the braces are uniformily spaced. If one or more of the braces are so segregated as to receive more than their portion of the load, they must be calculated separately from the rest.

In taking into account the angularity of the braces, the angle of each brace must be found and its section area must be reduced in proportion to the angle that the stay makes with a line drawn at right angles to the surface supported. This is to be done in preference to increasing the load in proportion to the angularity of the brace so as to avoid the necessity of calculating the area supported by each individual brace. The angle of each brace must be ascertained and if it is in excess of 15 deg. the area of the brace must be reduced by multiplying the area of the brace by the cosine of the angle that the brace makes with a line drawn at right angles to the area supported. The line representing the angle of the braces will be the center line of a rod brace, on gusset braces it will be the line intersecting the front rivet in the flange where it is riveted to the wrapper sheet and the bottom bolt in the backhead angle irons where the gusset plate fastens to the angle irons.

Brace rod jaws, brace feet, eyes, pins, rivets, bolts and angle irons should be made stronger than the body of the brace.

Cold or Hot Rivets?

Q.—What are the advantages or disadvantages of using cold-drawn rivets, cold riveted, over hot-drawn rivets, hot riveted? F. E. M.

A.—The advantages of cold-drawn rivets, cold riveted are:

(1) They are formed in solid die machines, have smooth surface, a round shank, a square end, and are made to close tolerances which enable them to be driven into rivet holes 1/32 in. larger than the rivet.

(2) The lower cost of applying cold rivets because they do not require heating.

(3) The lower cost of applying cold rivets because they are easier to handle than hot rivets, and riveting is done faster.

(4) Better fit is obtained because the hole can be reamed smaller without the allowance for expansion needed when using hot rivets.

The possible disadvantage to the use of cold-drawn rivets is the fact that they are limited in sizes. Cold formed rivets are made in diameters from ⅛ in. to 1 in. Standard cold heading equipment has a length limitation of about 4 in.; hence all rivets, regardless of diameter, longer than 4 in. must be hot formed. Cold riveting should be done with either pneumatic or hydraulic riveters of the squeeze type. This requirement also places a limit on the extent to which they can be used.

* * *

Milling keyways in driving axles at the Topeka, Kan., shops of the Atchison, Topeka & Santa Fe—A No. 3 air motor mounted in the tool post of an axle lathe drives a 1¼-in. milling cutter—The axle is clamped in position against rotation

ELECTRICAL SECTION

Upper left—In the truck repair pit where workers must operate in teams, Anna Natale, left, and Jennie Pelosi, right, both of whom have brothers in the Armed Forces, carry on in jobs formerly held by men. Upper right—Mrs. Madeline Guarascio, whose husband is now in the United States Tank Corps, operates a four-spindle drill press

Women Take Over

Fill places of husbands, sons and brothers in New Haven electric locomotive shop

Mrs. William Winter. armature-winders' helper, works with the winder on a main generator set—Mrs. Winter's husband, now a seaman, first class, was formerly employed by the New Haven in these same shops

With their Marine Corps son, William Grossjung, Jr., fighting the Japs in the South Pacific. Mr. and Mrs. William Grossjung, Sr., devote 100 per cent of their time toward speeding the day when he'll come home—They are shown rebuilding a main transformer

Mary Falkowska, armed with asbestos gloves to protect herself against the hot metal, cleans and tins armature coil copper—Miss Falkowska is taking the place of her brother, formerly employed in these shops and who is now working for Uncle Sam

TURNING THE TABLE

by Walt Wyre

"LOCOMOTIVES should be built with the cab in the middle and a pilot at each end," Ned Sparks, electrician for the S. P. & W. at Plainville, remarked as he dumped a load of tools on the work bench in the electric shop and sat down beside them.

"Might have a little trouble finding a place for the tank," Johnson, another electrician, said. "Besides, what's the idea of wanting a locomotive to look like a two-headed calf in a side show?"

"Turntables!" Sparks snapped. "They are more grief than anything else at a roundhouse! When they will run, they can't be stopped long enough for maintenance; when they won't run, everybody is anxious as an expectant father pacing a hospital hall."

"That's right," Johnson agreed, "but I don't see any use worrying about it. The roundhouse foreman chewed half a plug of horseshoe in the two hours the table was stopped this afternoon, but if it hadn't broke down he would have needed some other reason for delays.

"The 5092 was called for 5:30 and wasn't even fired until 5:10. It had only about ninety pounds of steam when the hostler took it out of the house right after we finished patching the controller. Hope it hangs together until morning, the controller, I mean," Johnson added.

"Yeah, so do I." Sparks slid from the bench and started peeling off his overalls. "A new controller was ordered about eight months ago. The storekeeper told me last week it had finally been shipped."

"Well, it sure is needed," Johnson remarked as he left the shop.

Sparks hung up his overalls, placed the tools in a drawer and headed for the time clock.

NEXT morning about ten o'clock, the turntable quit again. Jim Evans, the roundhouse foreman, found Sparks. "Get it going as soon as you can. There are three engines called and two to put in the house," the foreman told Sparks.

The trouble was in the controller again, broken spring on one of the contactor fingers. Sparks went to the storeroom for a new spring and wasn't surprised when there wasn't one.

"There is a whole new controller, though," the storekeeper told him.

"Can't use it right now," Sparks said. "What I need is a spring like this, only not broken."

After a few minutes search, a spring was found that while not identical with the broken one would answer the purpose. It didn't take long then to get the table turning again. Then Sparks told Evans about the new controller and asked him when would be a convenient time to put it on the turntable.

"There isn't such a thing as a convenient time to tie up the turntable," Evans said. "How long will it take to install the new controller?"

"About ten or twelve hours, if we have good luck."

Evans groaned. "Well, guess we might as well figure on doing it. Let's see—today is Friday—how about Tuesday?"

"That's O.K. by me," Sparks agreed. "We'll figure to start on it at eight o'clock Tuesday morning."

Sparks turned to leave, but was stopped by John Har who came out and handed Sparks a traingram from master mechanic's office.

The electrician read the message and swore.

"Bad news?" the clerk asked.

"Not so bad I can't bear up under it," Sparks t him. "The motor on the new well at Sanford ke stopping. The water service supervisor claims it's l voltage."

Next morning Sparks went to the master mechani office and showed him the traingram. H. H. Car master mechanic for the Plains Division, read the tra gram, then asked, "What will it take to correct trouble?"

"Well," Sparks replied, "if the trouble is low volta as the water service supervisor claims, I have an i the line wires should be larger. We have never had trouble with low voltage at Sanford before and the wires are small enough that it could be voltage dr causing the controller to kick out."

"Maybe you had better go to Sanford Monday a fix it. How long will it take?"

"Oh, Johnson and I should be able to change wires in one day." Then Sparks remembered about turntable controller to be installed Tuesday.

"Well," the master mechanic hesitated a mome "maybe you had better go to Sanford Sunday evenin That will give you all day Monday and you can co back Monday night on the Limited."

That being settled, Sparks went back to the elect shop. He found Johnson bending a goose-neck half inch conduit and asked what it was for.

"You know Evans has been hollering for a light the east end of the grease house," Johnson explains "I thought I might as well put it up while there was little time."

"O.K.," Sparks agreed with the idea. "We've g to go to Sanford Sunday and run heavier line wi to the new well motor."

"What's the matter, won't that number eight we r hold the poles up?" Johnson laughed, thereby indicati he had just pulled a good joke.

Sparks ignored the Hopish attempt and said, "I fi ured number eight might be slightly small for the li when we put it up, but it was all we had at the ti We've got some number four now. That will be plen large, besides, we need some eight to run for ligh in the new yard office they are building at Sanford. Y go ahead with your light. I'll see about shipping t wire and tools."

AFTER the material was ready to go, Sparks asked t store department truck driver to haul the turntable co troller, resistors, and a roll of number four rubb covered wire to the electric shop. He uncrated the co troller and resistors and was examining the control when Johnson came in.

"Need any help on the light?" Sparks inquired.

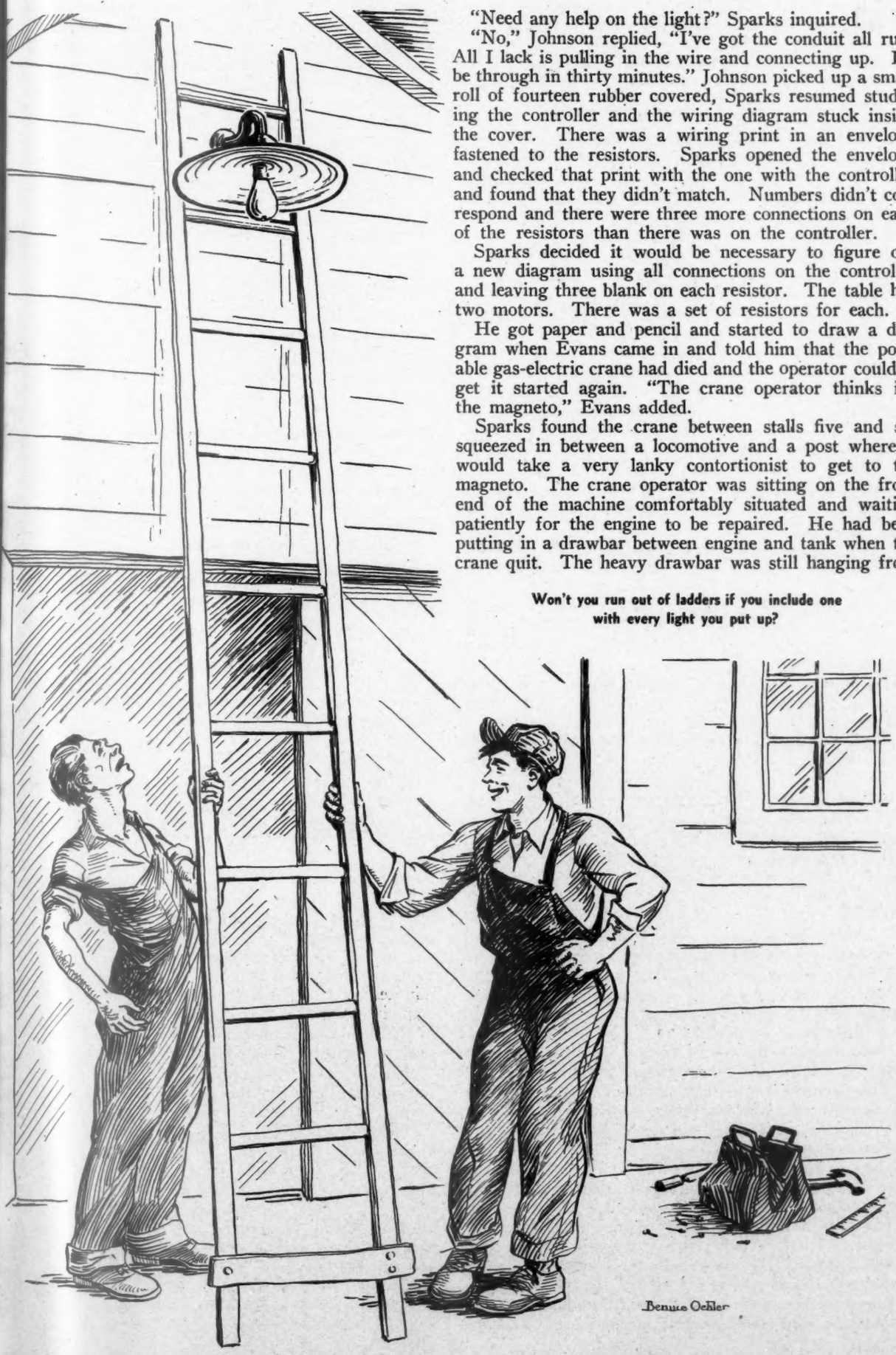
"No," Johnson replied, "I've got the conduit all run. All I lack is pulling in the wire and connecting up. I'll be through in thirty minutes." Johnson picked up a small roll of fourteen rubber covered, Sparks resumed studying the controller and the wiring diagram stuck inside the cover. There was a wiring print in an envelope fastened to the resistors. Sparks opened the envelope and checked that print with the one with the controller and found that they didn't match. Numbers didn't correspond and there were three more connections on each of the resistors than there was on the controller.

Sparks decided it would be necessary to figure out a new diagram using all connections on the controller and leaving three blank on each resistor. The table has two motors. There was a set of resistors for each.

He got paper and pencil and started to draw a diagram when Evans came in and told him that the portable gas-electric crane had died and the operator couldn't get it started again. "The crane operator thinks it's the magneto," Evans added.

Sparks found the crane between stalls five and six squeezed in between a locomotive and a post where it would take a very lanky contortionist to get to the magneto. The crane operator was sitting on the front end of the machine comfortably situated and waiting patiently for the engine to be repaired. He had been putting in a drawbar between engine and tank when the crane quit. The heavy drawbar was still hanging from

Won't you run out of ladders if you include one with every light you put up?



the crane hook. A machinist and helper, their work stopped by the crane quitting, had climbed up in the engine cab to wait and watch while the crane was being repaired.

Sparks surveyed the situation and decided it would be necessary to move the crane back at least a couple of feet before he could get at the magneto.

"If you'll get a chain hoist, I'll get Johnson to give us a hand here," Sparks told the crane operator.

JOHNSON had just finished the light and stepped back to admire the job when Sparks got there. "Pretty neat, eh?" Johnson said when Sparks came up.

"Not bad!" Sparks glanced at the light, then looked more closely. "Won't you run out of ladders if you include one with every light you put up?"

"What do you mean 'run out of ladders'" Johnson asked, then said, "Well, I'll be damned!"

The ladder had been leaning against the building when the electrician had put the conduit through the wall. He hadn't noticed that the conduit was between the rungs of the ladder. The reflector was too large to pass between the ladder rungs, which left three choices: leave the ladder there, saw out a rung, or remove the reflector so the ladder could be lifted off.

Johnson, grinning sheepishly, started to climb the ladder to remove the reflector when Sparks told him about the crane.

"If you tell anybody about that ladder, I'll kill you," Johnson threatened, as they walked back to the roundhouse.

"Oh, I won't tell anybody," Sparks promised, "and if anybody asks me how the ladder got hung on the conduit, I'll tell them it's a new way of keeping ladders from getting lost."

The crane operator was waiting with a chain hoist when the two electricians got back to the crane. They hitched one end of the hoist to a post and the other to the back of the crane and pulled the machine back a couple of feet.

"Turn the engine over," Sparks said to Johnson.

Johnson cranked while Sparks held a screw-driver about a sixteenth of an inch from a plug terminal and the point of the screw-driver resting on the cylinder head. There wasn't any spark. He tried all four plugs the same way with the same result.

"Looks like the magneto is bad," Sparks said.

"That's what I thought," the crane operator said. "It's been missing and hard to start several days."

Sparks removed the magneto from the engine and took it to the electric shop. The points were slightly burned, but not badly. He dressed the points and adjusted them, then tested the magneto by placing a wire in the distributor connection and held the other end of the wire about a quarter of an inch from the magneto while Johnson turned the magneto.

"That spark is hot enough to burn a wet dog," Johnson commented as he watched.

"Well, let's see what it will do on the crane engine," Sparks said.

Johnson cranked until he was worn out, then the crane operator tried it. The engine tried feebly to start several times, but never quite made it.

"How are the spark plugs?" Sparks asked the crane operator.

"Don't know," the crane operator admitted, "haven't looked at them lately."

"I'll go to the storeroom and see if they have any new spark plugs," the crane operator said.

Sparks removed the plugs and tested them by laying them on top of the engine with the wire connected while Johnson cranked. Two of the plugs wouldn't fire at all, one fired feebly across the points, while the other one fired up in the shell of the plug.

"That's the trouble," Sparks said.

The crane operator returned from the storeroom empty handed. "The storekeeper called several places in town and none of them had any plugs that will fit," the crane operator said. "We might get these cleaned and tested up town," he added.

"Well, whatever it takes, get it going soon as possible," Jim Evans, who had come up, added his bit to the discussion.

Two of the spark plugs were still bad after being cleaned. The garage man found two second-hand plugs that tested O.K. When the four good plugs were in the motor, it ran O.K. and everybody was happy again.

Johnson went back and removed the reflector so he could get the ladder off the conduit in one piece, then replaced the reflector while Sparks did a few odd jobs.

SUNDAY evening the two electricians went to Sanford.

Monday morning at eight o'clock they were ready to go to work renewing the line to the pump motor, but water was low in the tank and they couldn't shut down the pump. It was one o'clock before Sparks and Johnson started taking down the line and everybody from the call boy to the trainmaster wanted to know how long the pump would be shut down.

"Do you suppose we will get it done in time to catch the Limited back to Plainville?" Johnson asked Sparks.

"We should be done by 6:30."

"The Limited is due to leave at 6:20 but it's been running anywhere from one to four hours late."

At 6:45 the last connection was made and they were ready to start the motor. Sparks came down the pole and took off his hooks.

"Have you heard how the train is?" Johnson asked as he started over towards the switch.

Before Sparks could reply a locomotive whistle answered the question.

"Turn the motor on; if it runs in the right direction, we can just make it," Sparks said as he began gathering tools.

Rotation was wrong and the Limited left before they were ready to go. An extra freight called for 8:30 left Sanford at 9:45 and arrived in Plainville at 2:30 in the morning.

The two electricians were both red-eyed and sleepy next morning when they reached the roundhouse a few minutes before eight o'clock. They expected to find the roundhouse practically empty so they could kill the power to the turntable at once and start removing the old controller. Instead every stall held an engine as usual.

Sparks found the foreman and in spite of being very much out of humor, the electrician managed to speak evenly: "We are ready to start on the turntable."

"What!—I'll swear I forgot all about the turntable!" Evans took a chew of horseshoe and scratched his head. "Say, isn't there some way you can change out the controller without tying up the table ten or twelve hours? I don't see how we are going to run trains without getting engines in and out of the roundhouse. You've helped me out of tight places before. I'm sure you can help me now."

"I don't see how I can do it without shutting down the turntable." Sparks' voice held more sympathy than

(*Continued on page 384*)

Vitamins for Diesel Power

Part II

By Walter H. Smith*
and
A. H. Candee*

Operating characteristics of the Autoload control for Diesel engines

AUTOLOAD control is, in its fundamentals, the simple differential field system of control for Diesel-electric locomotives (described in the preceding issue) to which has been added a small exciter field regulator to compensate for variations due to electrical temperature change or to changes in engine capacity. The electrical connec-

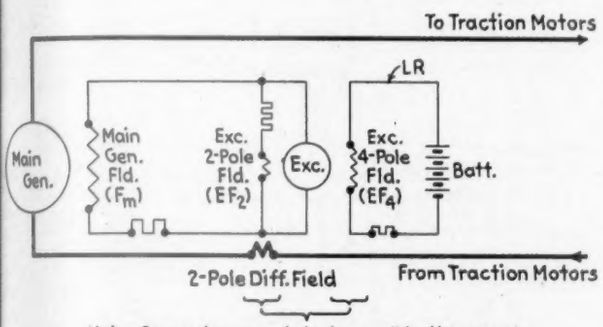

To Traction Motors
LR
Main Gen.
Main Gen. Fld. (F_m)
Exc. 2-Pole Fld. (EF_2)
Exc.
Exc. 4-Pole Fld. (EF_4)
Batt.
2-Pole Diff. Field
From Traction Motors
Note: One subsequent design splits these pole groups into two separate 4-pole field assemblies to obtain nearly as good characteristics

Fig. 7—Schematic wiring diagram for Westinghouse Autoload control

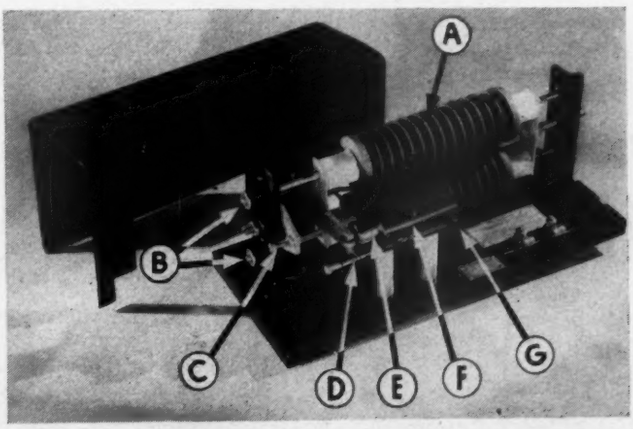
tions are shown schematically in Fig. 7. These connections are the same as those used for the differential field system except that a variable resistor has been inserted in the circuit from the battery to the 4-pole exciter field and some of the permanent resistance has been removed from this circuit. The resistance value in the field circuit is then automatically varied by action of the engine speed governor (as explained more in detail later), being a minimum at all times that the engine is not taking full fuel.

The use of a field regulator in conjunction with the differential field control system allows some modification in the power output setting of the differential system. With the regulator so controlled that an engine overload tends to increase the resistance in the exciter field circuit (to reduce the main generator output), it is feasible and desirable to adjust the differential field control setting so that it will normally try to take excess load from the engine (approximately 15 per cent) with the regulator resistance at its minimum. At the same time, the engine fuel input per cylinder is limited to that which is considered to be a safe maximum operating value so that at no time can the engine actually be overloaded. With these settings, the regulator mechanism is located and adjusted for automatic operation from the engine governor.

In its present form, the variable resistor of the Autoload system is a carbonstat, in which a carbon pile resistor is compressed or expanded by springs through the action of an oil operated piston. With no oil pressure against the piston a strong spring compresses the carbon-pile and reduces its resistance to a minimum. As the piston moves outward under oil pressure, it opposes the strong spring and allows a weaker spring to take effect to reduce the pressure between the carbon discs and thus increase the resistance, this change of resistance being very gradual.

Oil under pressure is admitted to or released from the operating cylinder of the carbonstat by means of a fairly simple pilot valve mounted adjacent to or on the engine speed governor and opened by a projection of the governor fuel arm. The pressure oil for the operation of the carbonstat is usually taken from the supply which actuates the governor.

Autoload control has had its growing pains. When first applied, the carbonstat had complete control of the engine loading, being placed in the circuit between the exciter (not of the differential field type) and the main generator field. Later, to effect a simplification and to improve the reliability, the carbonstat was transferred to the exciter field circuit and the differential field type of exciter was used. The final simplification has removed a compensating piston from the carbonstat and a compensating sleeve from the pilot valve at the governor.



A—Carbonpile
B—Pressure release springs
C—Pressure spring
D—Travel limit indicator
E—Operating piston
F—Operating cylinder
G—Connection for oil pipe from metering valve

Fig. 8—Type TS 31-A Carbonstat

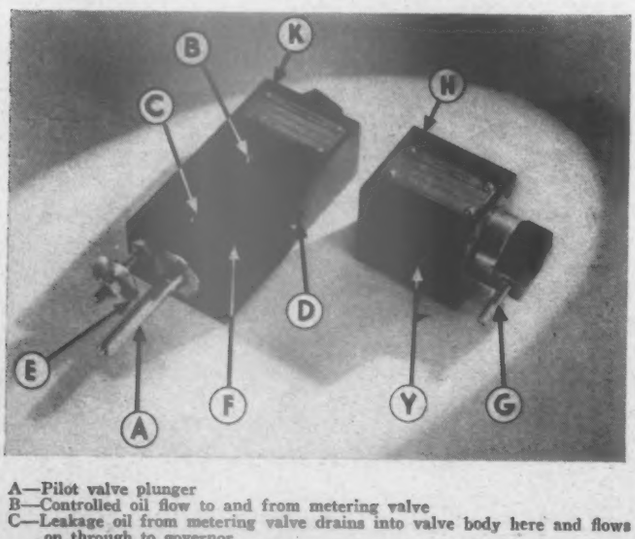
In its present form, the load regulating apparatus of Autoload control consists of three simple devices. The carbonstat is shown by Fig. 8, the pilot valve, located at

* Both Mr. Smith and Mr. Candee hold the position of transportation engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

the engine governor, and the metering valve are shown in Fig. 9. Figure 10 shows the general system of operation in schematic form.

Autoload control is simple. At all times that the engine is not loaded to its full capacity, the plunger *A* of the pilot valve is down below the full fuel position shown in Fig. 10, thus opening the port *B* to the upper chamber *C* of the pilot valve. This allows oil from the carbonstat operating cylinder (assume the metering valve to be in the position shown) to escape to the governor sump and thus causes the pressure spring to squeeze the carbonpile and reduce its resistance to a minimum. As the engine reaches its fully loaded condition, the pilot valve plunger *A* is moved by the governor arm to the full fuel position shown in Fig. 10, thus closing the port *B* and maintaining the operating piston in whatever position it was just before the full load occurred. Excess load causes a slight drop in speed which raises the pilot valve plunger *A* to connect the port *B* to the pressure oil supply chamber *D*. Oil then flows to the cylinder of the carbonstat to force the operating piston outward and thus relieve some of the pressure from the carbon pile. This increases the resistance in the exciter field circuit and continues until the main generator voltage has been reduced a sufficient amount to relieve the engine overload conditions and allow the governor fuel arm (and the pilot valve plunger) to return to its normal full fuel position. This again closes port *B* to hold the load conditions fixed. Any increase in engine speed due to a falling load, then, tends to boost the generator loading and any drop in engine speed due to increased load tends to relieve the load output of the generator.

The metering valve shown by Fig. 10 is used to prevent "hunting" or surging in engine speed. As is the case in nearly every engine loading scheme, there is an inevitable time lag between the indication (by the engine governor) of an overload or an underload condition and the actual correction of load by a change in the generator output. Since the loading conditions may continue to deviate farther and farther from full load during this time interval and thus indicate that more and more correction is needed, there is usually a tendency (unless prevented) to overcorrect the loading which, in turn, makes it necessary to recorrect in the other direction. This overcorrection, first in one direction and then the other, causes "hunting" of the load regulating system and may cause the engine to swing widely in speed se



A—Pilot valve plunger
B—Controlled oil flow to and from metering valve
C—Leakage oil from metering valve drains into valve body here and flows on through to governor
D—Oil under pressure from governor enters here
E—Guide disc registers with mark on plunger at full lead position
F—Screw holes for bolting pilot valve to governor
G—Rotating portion of metering valve—engine driven
H—Metering valve
K—Pilot valve
Y—Oil to or from operating piston of Carbonstat

Fig. 9—Type UE-618 pilot valve and metering valve

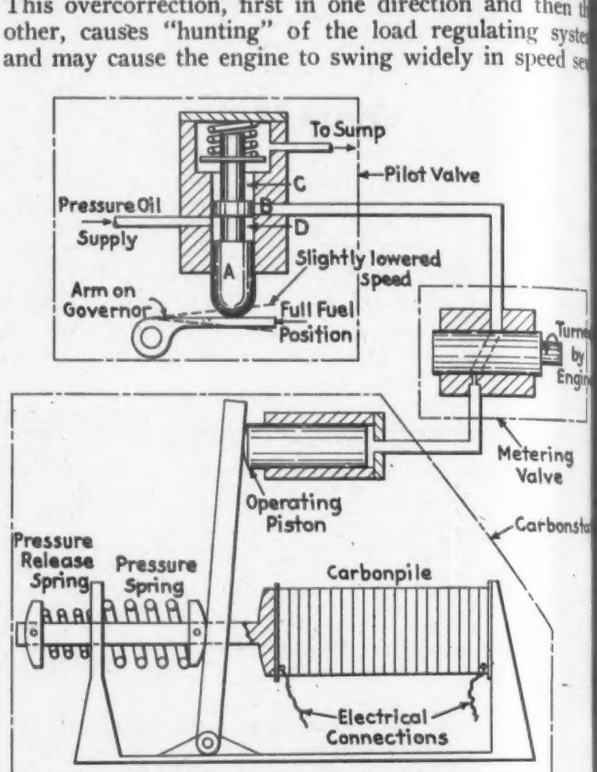


Fig. 10—Schematic diagram of the Carbonstat showing its method of operation

eral times before settling down to the correct load condition.

It is the purpose of the metering valve to cause a delay in the operation of the carbonstat so that the change of load will be gradual to prevent overcorrection.

The metering valve, in effect, is merely a rotating cylinder with a hole bored through it, this hole registering periodically with corresponding holes in the metering valve body. The passage of oil from the pilot valve to the carbonstat operating cylinder, then, is not continuous but occurs periodically as the holes in the metering cylinder register with those in the body. Because of this intermittent passage of oil, the metering valve is often called the "spitter." The amount of oil "spit" through per revolution is limited by restricting one of the body ports.

In operation, Autoload control is smooth and utilizes the available engine power effectively. Since the engine output may vary considerably, from a high value obtainable with a new (or reconditioned) engine, cold intake, or high fuel setting, to the low output obtainable from an engine badly in need of repair or adjustment, Autoload control must be able to adjust the generator voltage (and consequently the electrical loading) over a rather wide range. Figure 11 illustrates the approximate limits of electrical voltage control with the engine operating at its full speed. The normal settings are made so that the engine will be loaded to its full capability even though this may vary from about 15 per cent above full load rating down to about 60 per cent rating.

The loading of an engine at speeds below its full operating speed is subject to some limitations. Since the power required for the initial acceleration of a train from standstill is considerably below that which the engine is

apable of developing even at its idling speed, it is customary and advantageous to make the initial power application with the engine turning over at this speed. The control system, even then, must incorporate an automatic limit to the power applied in order to provide for a smooth start.

In this respect, the differential field control has ideal characteristics because the initial power demand is low and because the engine is not required to develop full torque until full engine speed is reached. The power output rises automatically as the engine speed rises (although much faster) until full load is reached at full engine speed. Autoload control embodies this same characteristic, since the basic load regulation is that of the differential field control system.

Figure 12 shows the power output characteristics of Autoload control as related to varying engine speed. Curve *A-B-C* is the approximate load demand curve followed by regular differential field control at normal temperature of electrical equipment. Under cold generator and exciter field temperatures, this curve might vary toward the left, as shown by the dotted curve. If the engine power curve is normal, the differential field control curve will load the engine fully at full engine speed as shown at *C*. Under the cold electrical temperatures assumed, however, only 85 per cent power can be obtained at 82 per cent of full engine speed, and the engine speed cannot rise above this until the electrical temperature increases.

With Autoload control set to take a maximum of 115 per cent of full engine power at full engine speed, the

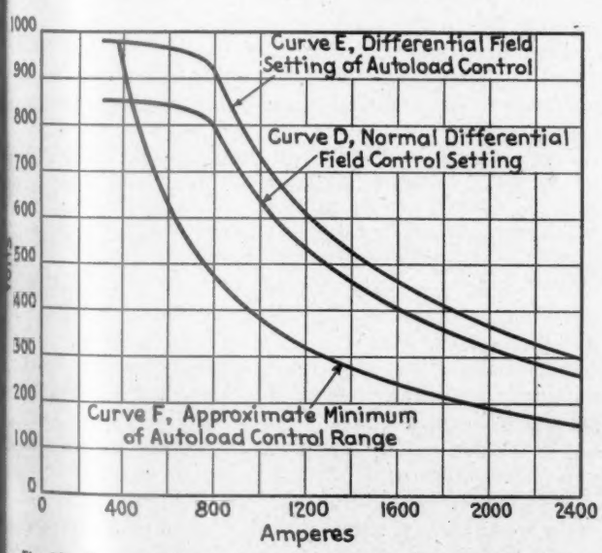


Fig. 11—Range of Autoload load variation for full engine speed

output is as shown by curve *AA-BB-CC*. It may be noted that, while the starting power is approximately the same as for simple differential field control, there is a definite improvement in overall performance at all engine speeds.

If the engine gives its rated output, the Autoload performance follows curve *AA-BB-CC* to point *BB*, where the carbonstat becomes effective to limit the power to full load and the output then follows along the rated power curve from *BB* to *C*. With excess engine power the output follows on up toward *CC*, instead of toward *C*. With an engine in extremely poor condition (say 60 per cent of rating), the output is from *AA* to *D* to *E*. Under these conditions, where the power is limited, Autoload control has the inherent characteristic of loading the engine to its available capacity at a lower engine speed than normal, which compensates to a slight degree for the falling off of engine power.

Under low electrical temperature conditions, Autoload control loads the engine in a manner similar to regular differential field control at all engine speeds up to the point where full engine torque (or full available output) is reached, such as point *F* on the rated engine output curve.

Above this speed, however, Autoload control limits the output to that available and thus allows the engine to rise to its normal speed, whereas simple differential field control would definitely hold the engine speed and available power to subnormal values.

The application of Autoload control to a Diesel-electric transmission system insures the most effective use of

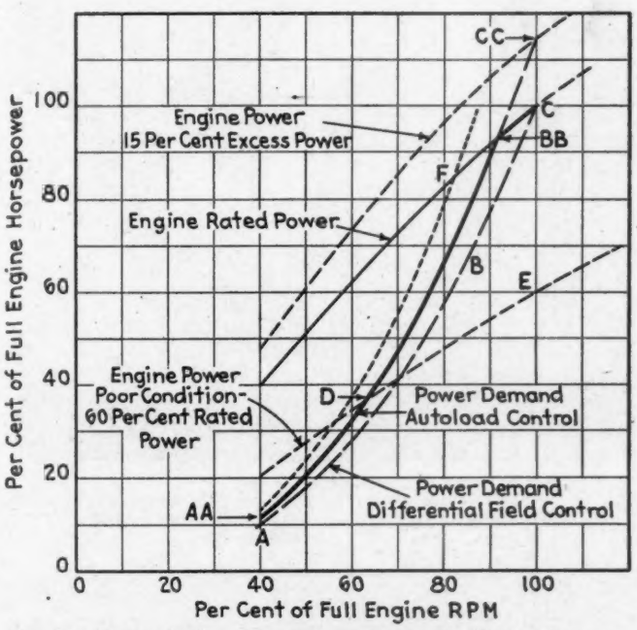


Fig. 12—Engine loading at various engine speeds—Values shown are approximate

all of the available engine power under all operating conditions and results in considerably improved performance of the unit, whether in switching work or in road hauls. Since this is accomplished with minimum stress and abuse of the engine and with but a simple addition to a tried and proven control system now in daily commercial use, Autoload control is prescribed as the best known vitamin for Diesel-electric motive power.

From 25 To 1,750 R.P.M.

Electronic control of motors is now offering new potentialities in speed control. The application shown in the illustration is that of a ⅓-hp. Thy-mo-trol drive used on a small drill press in the Schenectady plant of the General Electric Company. A range of operating speeds from 25 r. p. m. to 1,750 r. p. m.—obtained simply by turning a small knob on a push-button station—enables this simple drill press to do jobs that would otherwise require a much more complicated machine or perhaps several machines.

Speeds available on the drill are so much slower than those obtainable without changing pulleys on similar

drills that it can be used on hard-to-drill materials, such as molded compounds, and for the fly cutting of large diameter disks. Since the drive permits reversing as well as independent adjustment of speed in each direction, tapping can be done at the proper preselected speeds for both tap and back-out.

The motor controls are shown at the left—the apparatus required may be seen back of and above the operator's hand

Several hundred Thy-mo-trol drives of larger size are now serving the war effort by providing precise, convenient control of machine tools and a variety of other equipments.

Turning The Table

(*Continued from page 380*)

anger. "Anyway, I'll do my best. How soon can you let us have the table for a couple of hours?"

"Oh, about 10:30, I'd say." The foreman turned and went into the roundhouse.

"What's the verdict?" Johnson came up and asked.

"Same old story. I still say locomotives should be built with a pilot at each end. If you will get that roll of number four wire we can cut wires to approximate lengths and solder lugs on one end while waiting for the table."

It was eleven o'clock before the table was released, then Evans said he would have to use it again by twelve-thirty.

"Wish I had joined the Seabees," Sparks said.

"Yeah, and maybe now you would be fighting Japs with one hand and stringing wire with the other," Johnson said. "Why can't we hang the new resistors at a different place from where the old ones are and run the wires up into the cab, then it won't take long to connect them up."

"We could," Sparks squinted his left eye, "make temporary connections to the new controller before we take the old one out. If we used long enough wires we could set it in place, then run the permanent wires in conduit."

"That's one way of making a big job out of a little one," Johnson said, "but it could be done."

The turntable was never out of service over two hours at a time while the new controller was being installed, but it took Sparks and Johnson two days and four hours overtime to do it. The division engineer raised Cain because the labor cost exceeded the allowance, but otherwise every one was well pleased.

"WELL, looks like we might have a little time to clean a few motors and do a little maintenance in the next few days," Sparks remarked when he came into the electric shop the morning after the turntable job was finished.

"Master mechanic wants to see you," John Harris stuck his head through the door and said to Sparks.

"They are still having trouble with the well motor at Sanford," the master mechanic told Sparks. "I thought you fixed it."

"I did put up heavier wire. The trouble must be something besides low voltage," Sparks said.

"Well, they ran out of water yesterday before any one noticed the motor was stopped. Better find what's causing the trouble and correct it."

That afternoon Sparks went to Sanford. He went directly to the roundhouse from the station. A voltage test showed 446 volts on the line which was plenty good. Using a split core meter, he tested to see how much current the 10-hp., 440-volt motor was using. The meter showed nearly thirteen amps which wasn't excessive. He went to a hotel and asked for a room. There wasn't any. He decided if he had to sit up all night he might as well work.

He again checked voltage and current. Both were the same as before. Then he didn't know what else to do. He sat down and lighted a cigarette. While he was sitting smoking and thinking, the night pumper who also handled fuel oil and water treating plant came up and started to open a valve.

"What are you going to do?" Sparks inquired with very little interest.

"Open the valve to the sump and close the valve to the storage tank," the pumper said. "The storage tank is nearly full."

When the valves were changed, Sparks picked up his ammeter and tested the current. It had risen to almost sixteen amps. The overload relays were set to trip at fourteen and two-tenths.

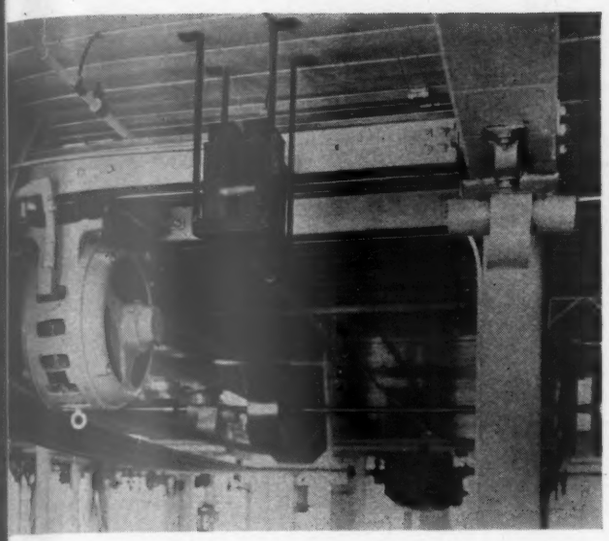
"So that's the reason the motor stops," Sparks said.

"Why?" the pumper wanted to know. "The supply tank is lots higher than the sump."

"Yeah, that's why it's not overloaded pumping into the tank. Close the valve a few turns—turn it slow." Sparks watched the ammeter while the valve was being closed. The hand gradually fell back until it reached the same value as when pumping into the tank. "Now, if you don't open the valve any more than that when pumping into the sump, the motor won't stop."

Sparks found a caboose cushion and a soft place on the cement floor of the oil house and went to sleep.

CONSULTING DEPARTMENT



Capacitors

How can I tell when a capacitor is not operating properly?

An Ammeter and a Voltmeter Will Tell the Story

A capacitor used for power-factor correction is simply a static condenser connected in shunt across the line. Modern capacitors consist of alternate layers of aluminum foil and insulating paper rolled into a compact form and immersed in either vegetable, mineral, or synthetic oil in a hermetically sealed metal container. Synthetic oils, such as Pyranol or Inerteen, are most used today. Usually several layers of paper are used between the aluminum sheets to prevent the superimposing of conducting spots which are unavoidable in commercial papers.

The kva. of a capacitor varies directly as the applied frequency, and its capacitance, and as the square of the applied voltage, and is expressed by the formula, kva. (reactive) $= EI = \frac{2\pi fCE^2}{1{,}000}$. To test a capacitor or bank of capacitors to see if they are operating properly it is only necessary to use a voltmeter and an ammeter, preferably one of the clip-on type. Take a reading of the voltage applied to the capacitor and the resulting current flowing through it.

For single-phase, or if testing just one phase of a three-phase installation, the current should be, $I = \frac{\text{kva.}}{1{,}000E}$

If measuring the line current of a three-phase installation the current should be, $I = \frac{\text{kva.}}{1{,}730E}$. (For all practical purposes on three-phase 230 volts figure 2.50 amp. per kva., and on 460 volts 1.25 amp. per kva., where the kva. is for the entire three-phase installation.) As can be seen from the formula the current varies as the square of the voltage, so if the voltage applied is not as rated on the capacitor, a correction is necessary. For example, if a capacitor is rated at 230 volts, and the voltmeter indicates an applied voltage of 260 volts, the ammeter should show a current flowing of $\frac{(260)^2}{230}$ or 28 per cent greater than rated normal current. (For best operation the average voltage over a 24-hour period applied to a bank of capacitors should not exceed the rated voltage by more than 5 per cent.

If the current flowing is greater than that which can be accounted for by the calculations above, there is the possibility of an excessive third harmonic present in the applied voltage. It might be well to check the supply system for unbalanced conditions, particularly for open-delta transformer banks which are often the source of third-harmonics. In no case should the kva. (1.73EI) be allowed to exceed 35 per cent the rating of the capacitors if damage is to be avoided.

Capacitors seldom develop open-circuits and of course if one exists no current will flow. Since banked capacitors are of necessity connected in parallel, a short-circuit occurring in any one of them will short-circuit the entire bank and blow the fuses. Capacitors should be protected by the nearest size fuses to 150 per cent of the proper current for their kva. rating. For 2,300-volt capacitors, manufacturers recommend using fuse links not larger than 75 amp. which limits the size of a bank to 180 kva. (The common size of single capacitors are 15 kva. single-phase units.) Two hundred and thirty and 460-volt banks on one set of fuses are usually kept down to 90 kva.

If the capacitors are to be tested with the power disconnected, care must be taken that they are discharged to a safe value before being handled. Modern capacitors are built with internal discharge resistors that should reduce the residual charge to 50 volts or less within five minutes. As as extra precaution a temporary short-circuit may be applied between terminals, and between terminals and the grounded case. A magneto should not be used for testing capacitors because on account of its alternating-current characteristics it will ring whether the capacitor is short-circuited or not. A constant-pressure Megger is the best instrument to use. With a short-circuit it will read zero, and on an open-circuit infinity. For a capacitor in normal condition it will give a steady reading somewhere between zero and infinity depending on the conductivity of the dielectric, which is never a perfect insulator.

ROLAND BERTI,
Union Pacific,
Omaha, Neb.

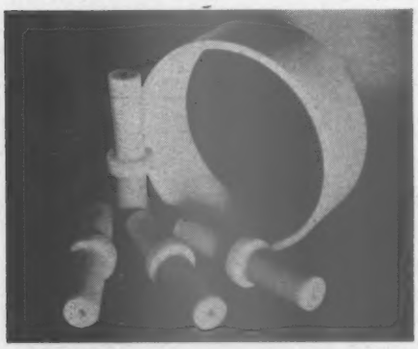
Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York, N. Y.

A number of our a. c. and d. c. machines remained submerged for four days during a recent flood. What is the easiest way of restoring these machines to service?

NEW DEVICES

Insulator Glassware

A line of electrical insulation known as Multiform insulators is announced by the Corning Glass Works, Corning, N. Y. The multiform process involves a combination of cold-molding batch materials and subsequent fusing. This allows the making of glass insulators in a wide variety of shapes and sizes ranging from small insulating beads to large insulators weighing 25 lb. or more. Countersunk and tapped holes are practicable as are both external and internal threads and grooves. The insulators can be molded to small tolerances and can be ground and polished to closer tolerances if necessary.



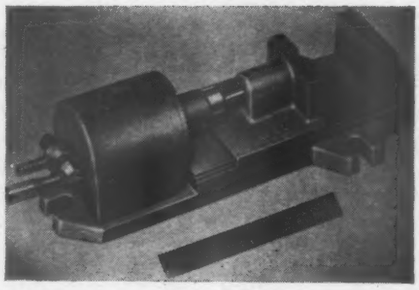
Examples of Multiform glass insulators

Mechanical and dielectric strengths are somewhat less than those for standard glass insulators. Water absorption is less than 0.01 per cent in 24 hrs. Impregnants or added glazes are unnecessary.

Air Vise

An air vise for clamping work pieces firmly in position for drilling or milling operations is being offered by the Mead Specialties Company, Chicago. Known as the Mead Air Vise, Model 42, the unit can be furnished with hand control or with one of two types of foot control. In one case pressure on a foot pedal releases the jaws, in the other pressure on the pedal closes the jaws while the pedal is down.

Two jaw settings are provided. The smaller takes work from 0 to 2 in., the larger from 1⅜ in to 3⅜ in. Still larger openings can be had by moving the air cylinder farther back on the base of the vise. The use of dove-tail ways for the sliding jaw provides smooth action, free from play in any direction. Long ways keep the jaws parallel, even where work is held off center, and prevent any binding action from absorbing part of the holding power. The sliding jaw cannot lift as it closes on a cylindrical piece held horizontally.

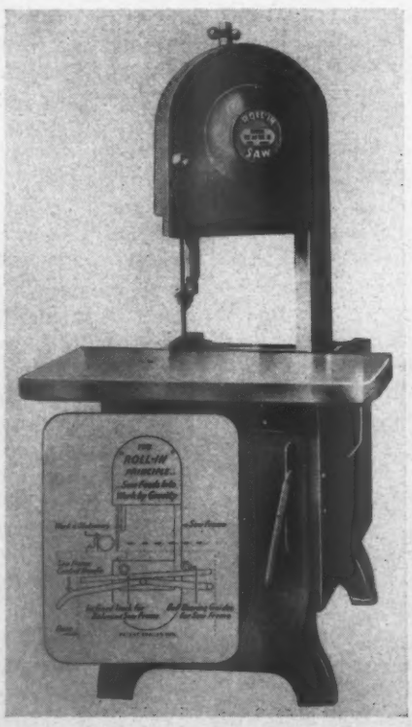


Work can be firmly held in this air vise for drilling or milling operations

The length of stroke can be controlled by means of an adjustable collar on the ram. The pressure factor is four times the line pressure.

Metal Cutting Bandsaw

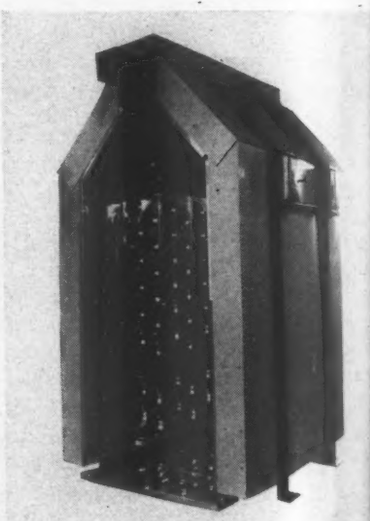
The Universal Vise & Tool Company, Parma, Mich., have introduced a metal-cutting bandsaw operating on a gravity feed principle. The saw blade is fed into the work through the movement of a balanced blade wheel frame mounted on an inclined track. Blade pressure is automatically regulated by the texture and degree of hardness of the metal being cut. No attention from the operator is required. Blade breakage resulting from incorrect pressure is eliminated. The saw is adaptable for cut off, trim and contour work. A swivel block for holding work is readily removable for contour sawing or long straight cuts. Three speeds of 81, 161 and 264 ft. per min. are provided. The area of the work table is 18½ in. by 30 in. and the height from the floor 30 in. The saw cut is vertical and down with a maximum cut of 7 in. vertically. The blade travels 7 in. into the work piece. By resetting the work, any depth of cut can be made.



A roll-in principle is used to feed the saw blade into the work

Infra-Red Oven

An insulated-reflective infra-red heating and baking oven made in sections to permit its assembly in various forms is now being made by Infra-Red Engineers & Designers, Cleveland, Ohio. The oven may be used for drying paint, for baking armatures and electrical coils, for making shrink fits, for drying metal parts, etc.



An oven section which includes a conveyor I-beam

Heat is developed by incandescent lamps with internal reflectors. The oven sections have reflective surfaces and are filled with Fiberglas for heat insulation.

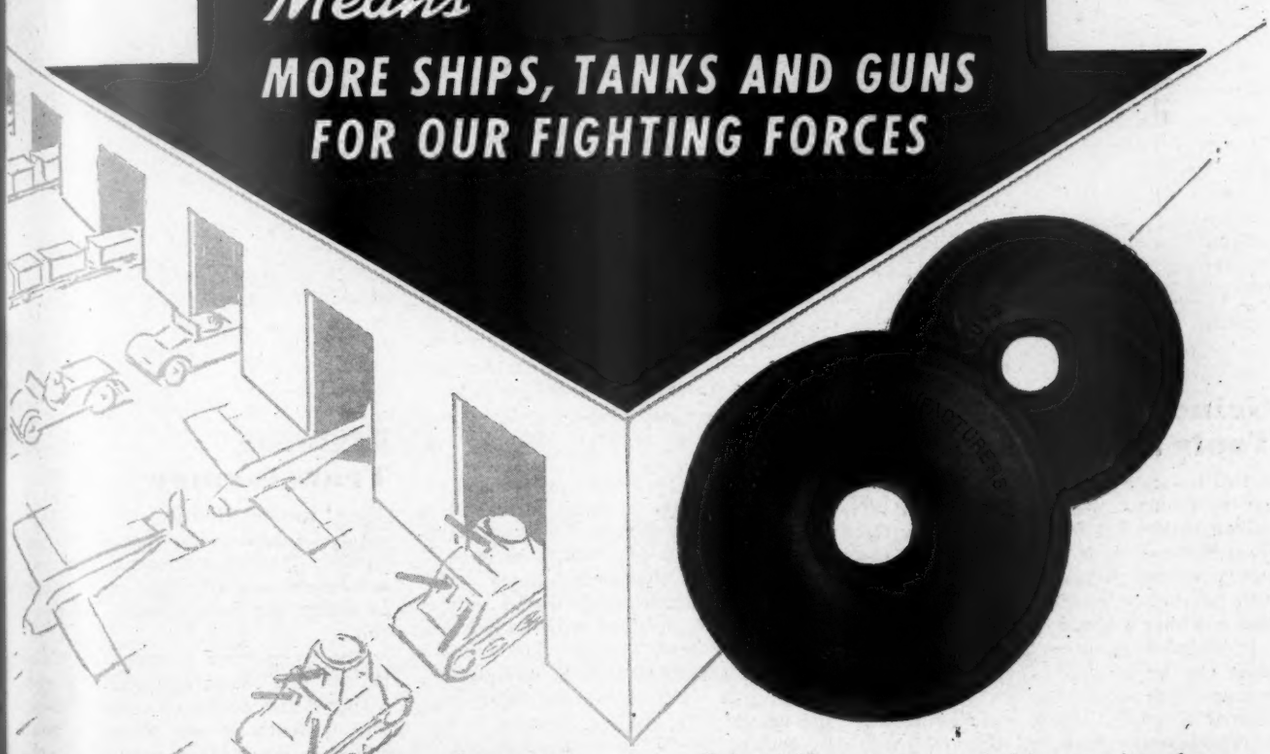
In addition to the primary air circulation upward within the oven proper, there is a secondary air circulation which meets the primary air in the fume duct where both join and go out the chimney together. Secondary air passes between the back of the reflective panel and the exterior covering of the oven.

(*Turn to next left-hand page*)

MORE METAL SAVED IN INDUSTRY

Means

MORE SHIPS, TANKS AND GUNS FOR OUR FIGHTING FORCES



Perhaps no other opportunity is offered the railroads to conserve as large an amount of metal as in the purchase of Chilled Car Wheels. The large saving of metal in the manufacture of Chilled Car Wheels is evidenced by the fact that in 1942 approximately 782,181 tons of the 885,020 tons of metal used in their production were scrapped wheels. This saving undoubtedly made possible the production of a very substantial amount of war materials.

Under our wheel exchange plan, by which the railroads receive new Chilled Car Wheels for old, on a conversion charge basis, the railroads send scrapped wheels to our 38 strategically located foundries in the United States and 8 in Canada, where they are speedily recast into new wheels.

Only 11.22 per cent new pig-iron went into the 885,020 tons of metal used in the manufacture of the 2,682,000 Chilled Car Wheels delivered to American and Canadian railroads in 1942. If the 782,181 tons of scrapped wheels used in making new Chilled Car Wheels had been *new* metal, our fighting forces might have had fewer ships, tanks and guns.

1942 CHILLED CAR WHEEL PRODUCTION:
2,682,000 Chilled Car Wheels were delivered in 1942.
885,020 Tons of metal were used to make them.
Of these:
782,181 Tons or 88.38% were scrapped wheels.
99,299 Tons or 11.22% were new pig-iron*.
3,540 Tons or .40% were alloys.
This *IS* Salvaging Scrap for the War Effort!
*Secured with the cooperation of W.P.B.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

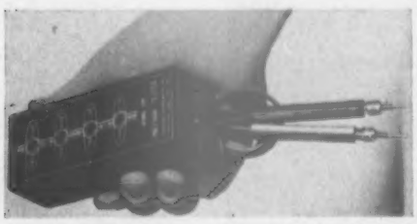
AMCCW

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

3351

Voltage Tester

A voltage tester which is made up essentially of four neon lamps and a network of resistors is being offered by the Superior Instruments Company, New York. It indicates whether the voltage is 110, 220, 440 or 660, and whether the current is a.c. or d.c. The model 590 illustrated is 5 in. long, 1¾ in. wide, 1⅝ in. deep and weighs 5 oz. The front panel is steel, the box is wood and the instrument is provided with needle-pointed test prods for making the necessary contacts.



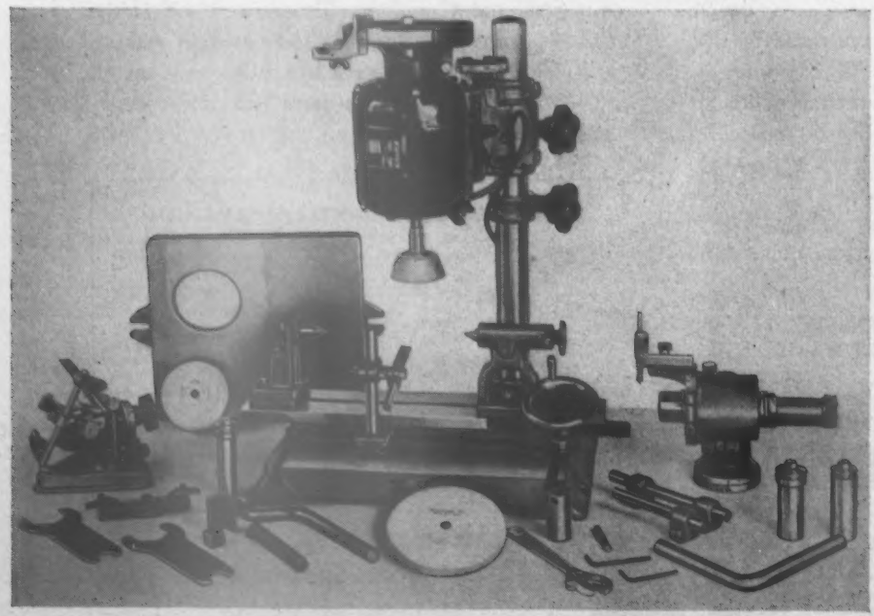
The model 590 voltage tester

Grinder for Tools and Cutters

A tool and cutter grinder equipped to handle the grinding of practically all types of milling cutters has been introduced by the Roan Manufacturing Company, 1225 Washington avenue, Racine, Wis. It is also used for contour grinding, and, being portable, it makes a useful bench grinder.

It includes features that are said to make for simplicity of operation, fast set-ups and high-speed precision grinding of assured accuracy. These features include a motor grinder head and bracket which can be raised, lowered and swiveled around, accurate vertical adjustment being assured by a vernier feed on the motor bracket. The motor itself can be swiveled to bring grinding wheels into any desired position.

Complete fixtures and accessories are provided to accommodate various types of tools. Among these is a precision slide which can be used independently of the grinder as a bench center for indicating and inspecting tools. There is also an outside diameter grinding fixture which is used for holding end mills and milling cutters, and special form tools which cannot be held on center. It is also employed in grinding the end of end mills, side cutting teeth of milling cutters and many other facing tools in a wide range of sizes. The unit has a base 18 in. by 16 in. and the column is 25 in. high. The weight, complete with all fixtures, is 175 lb.



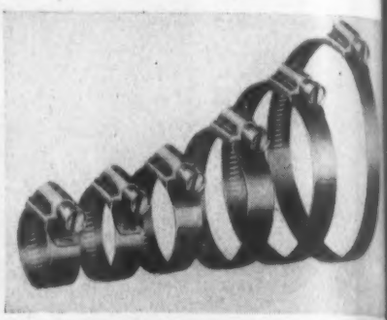
Grinder for milling cutters which can be adapted to many other tool-room needs

Hose Clamps

The Aircraft Standard Parts Company, 1711 Nineteenth avenue, Rockford, Ill., has recently introduced its line of Aero-Seal hose clamps in fourteen sizes from ¾ in. to 4 in. inside hose diameter.

The clamps consist of a 9/16-in. tempered steel band punched with holes corresponding to the teeth of a worm gear. These holes mesh with a worm in the housing welded to the fixed end of the band. The worm is turned by a screw driver, and the screw head on the worm is fitted with a safety cup which prevents the screw driver from slipping and puncturing the hose or damaging other equipment. Rapid action is obtained by a ten-pitch thread so that full take-up is obtained with only a few turns of the screw driver. The belt-like tightening action produces a uniform tangential pull which does not distort pipe and results in a leakless clamping action. By backing up the screw, the free end of the band comes out of the housing, and the clamp may then be sprung open and slipped over the hose in place on the pipe. Likewise, a clamp can be easily removed in the same manner. This operating convenience is obtained without loose pieces in the clamp unit.

The clamps are self-locking as a result of the worm and worm gear action and are virtually impossible to loosen even with severe vibration as long as the band is under tension. Lock wires are not necessary.



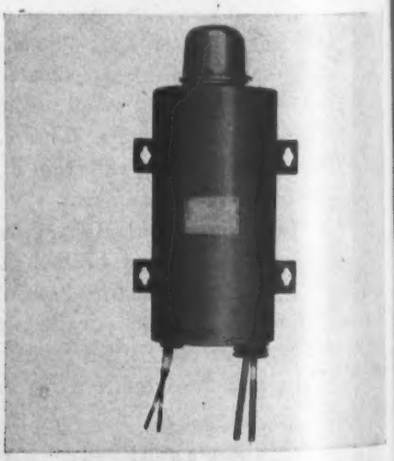
These clamps are drawn firm and tight by the use of a screw driver

Lighting Transformer

The Lighting Division of the General Electric Company has announced a series-multiple lighting transformer which affords a simple means of operating a floodlight or searchlight from a series lighting circuit.

The transformer is constructed with a built-in film cutout open-circuit protective wiring device which eliminates the necessity of mounting and wiring a separate protective device. It is designed to operate a standard 115-volt multiple floodlight or searchlight.

The use of the transformer is particularly advantageous at guard towers and other remote points, where the installation of a multiple circuit for the purpose would require extensive use of critical materials, and where a series lighting circuit is nearby.



G.E. series-multiple lighting transformer

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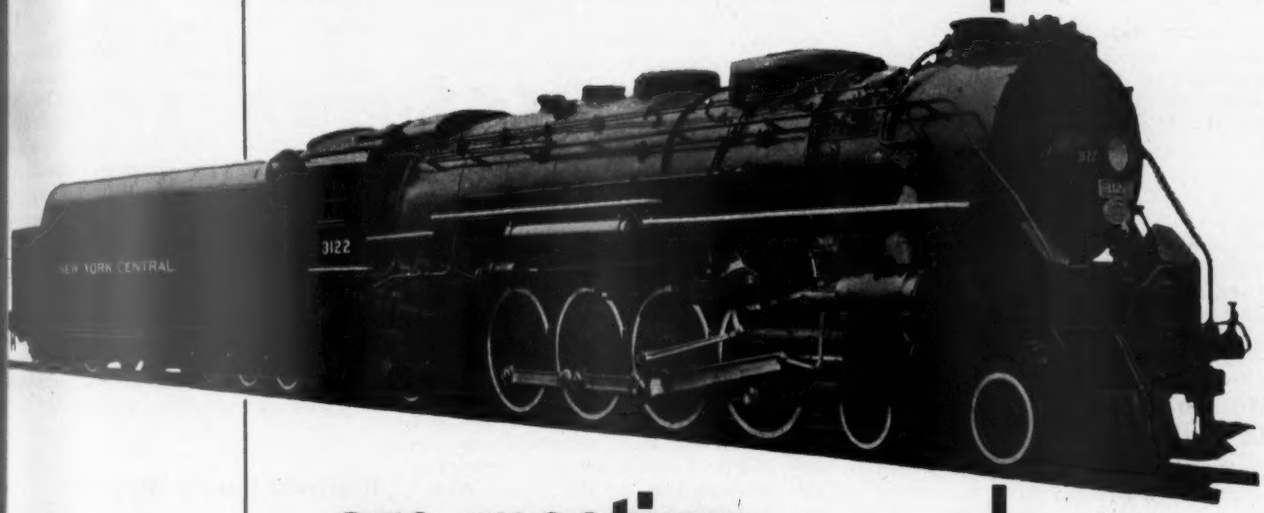
LIMA LOCOMOTIVES



are meeting the test of WAR

Locomotives are being worked longer and harder than ever in railroad history. Only in this way can the war-time burden of transportation be handled.

Railroad equipment of all kinds is undergoing a supreme test and out of this testing is coming confirmation of the soundness of Lima design and workmanship.

Lima power is standing up to its war-time job.

LIMA LOCOMOTIVE WORKS — LIMA LOCOMOTIVE WORKS INCORPORATED — INCORPORATED, LIMA, OHIO

High Spots in
Railway Affairs . . .

Those Grade Crossings

According to a report from the Grade Crossing Committee of the Association of Railway Claim Agents, the number of railroad grade crossings decreased from 235,827 in 1933 to 229,722 in 1941. The number of grade crossings not specially protected decreased from 205,199 to 196,863. While these decreases are gratifying they are far too small, as is indicated by the railroad grade crossing accidents last year. They numbered 4,150 and accounted for 4,616 injuries and 1,970 fatalities. This is not far from the average over recent years.

Human Element In Railroading

O. D. T. Director Eastman made a special trip to Cincinnati on July 14, to address a meeting of the leaders of the Railroad Y. M. C. A. He spoke highly of the zeal and enthusiasm with which railroad managements and employees have carried on during the emergency. He regards it as one of his first duties "to do nothing to impair their morale, but on the contrary, to do everything to sustain and promote it. * * * The purpose of the Railroad Y. M. C. A.'s, as I take it," he said, "is to promote the well-being of the railroad worker, both physical and spiritual, and they have been faithful and effective in accomplishing that purpose." At the very opening of his address he said: "We have not yet got to the point, and we never shall, where machines can function without the skillful aid and guidance of humans. Certainly there is nothing in the operation of our railroads which is of more importance, if the best results are to be secured, than the men and women who work for them, including not only the managers, but the entire body of employees. And I am also sure that the more these men and women have the inspiration which is born of religion, in its broader meaning, the better the work they will do."

Railroad Executive Drafted

The railroads have been operated so effectively in this World War that the government has not only not had to take them over, as the pessimists predicted, but it is drafting railroad executives for big and unusually difficult administrative assignments entirely outside the transportation field. Last September William M. Jeffers, president of the Union Pacific, was chosen by the War Production Board as the rubber administrator. In announcing this appointment, Donald M. Nelson, chairman of the W. P. B., emphasized that it was a tough job and that no chances could be taken in experimenting with a man about whose ability or performance there was any question. The improvement in synthetic rubber production has fully justified Mr. Nelson's choice. On June 28, the Secretary of the Interior, Harold L. Ickes, who is also acting as Solid Fuels Administrator for War, appointed Carl Elbridge Newton, president of the Chesapeake & Ohio, as director of mine operations for the federal government. In announcing the appointment Secretary Ickes said: "Mr. Newton's appointment as director of mine operations represents the selection of an individual with a vital public interest in and knowledge of coal, free of any partisan connection with either operators' or mine workers' organizations. He will be a full-time government worker whose services are loaned by his railroad as a contribution to the war effort. I am delighted to have been able to draft him for this unprecedented and extremely difficult task."

Women Railroad Workers

In the first quarter of this year, or between mid-January and mid-April, the number of women employed by Class I railroads increased about 30 per cent, or from 63,187 to 82,107. In the same period the total number of employees increased from 1,139,480 to 1,347,128; the percentage of women employed thus increased from 4.79 to 6.09. The number of women machinists increased from 4 to 29 and the number of women general laborers in shops, enginehouses and power plants increased from 2,629 to 4,504. These statistics are taken from the quarterly report of the Bureau of Transport Economics and Statistics of the Interstate Commerce Commission.

Oil for the East Coast

For the week ended July 10 the tank-car loadings of oil topped the one million barrel mark for the first time, with an average of 1,017,029 barrels a day. In addition to meeting the increased needs of the armed services, storage stocks in the eastern area are being built up to what might be considered a safe minimum. Meanwhile, on July 19, the final link was closed in "Big Inch," the world's biggest and longest oil pipe line. It extends from Longview, Texas, to Linden, N. J., a distance of 1,341 miles. Work on it was completed a little less than a year from the time it was started. It passes under 13 rivers, climbs eight mountain ranges, and tunnels under highways and railroads. At times the labor force reached 15,000; the project is said to have cost about $95,000,000.

Fourth of July Crush

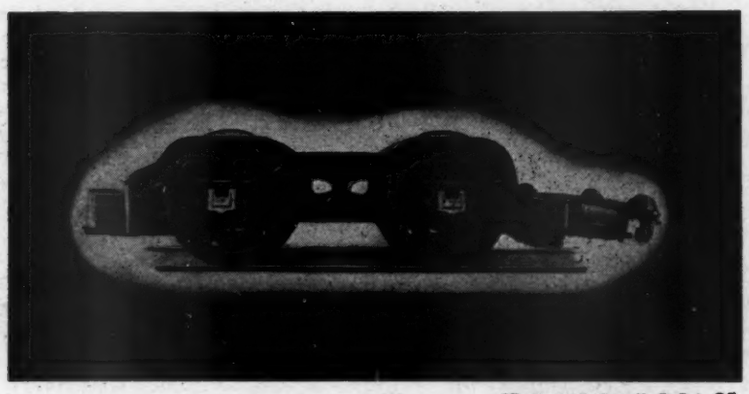
Despite the pointed warnings of th
O. D. T., both furlough and civilian pas
senger travel proved to be heavy over th
weekend which included July 4. Directo
Eastman of the O. D. T., suggests th
the Fourth of July experience has pro
vided a convincing demonstration of th
limitations of railroad passenger-carryi
capacity. With military and essenti
civilian travel increasing, he said, it wi
take only a small amount of unnecessary
travel in the weeks to come to produc
conditions of overcrowding such as pre
vailed over July 4 and "I am sure that n
patriotic American would deliberately d
anything to interfere with the movemen
of essential passenger traffic."

Railroad Safety Awards

Two agencies in this country are actin
in stimulating efforts to prevent accident
and establish high standards of safety o
our railroads. The National Safety Coun
cil grants awards each year to railroads i
various groups, based on the number o
man-hours worked, who make the bes
records in the prevention of casualties t
employees. The American Museum o
Safety sponsors the E. H. Harriman Me
morial Medals Award for those railroad
in three different categories as to size, tha
make the best record in accident prevention
as a whole, including passengers, employee
and other persons. The calculations are
weighted, in order to take into account the
relative importance of the different classes
of accidents. The National Safety Council
top awards for the year 1942 in the various
groups, include the Union Pacific, 50 mil
lion man-hours or more; Michigan Central
20 to 50 million man-hours; Duluth, Mis
sabe & Iron Range, 8 to 20 million man
hours; Bessemer & Lake Erie, three to
eight million man-hours; Lake Superior
& Ishpeming, one to three million man
hours; and Nevada Northern, less than
one million man-hours. The top award to
the larger Class I switching and termina
railroads (1,500,000 man-hours, or more)
went to the Conemaugh & Black Lick, and
the award to the smaller roads in this group
went to the Birmingham Southern. The
E. H. Harriman Memorial Medals were
awarded to the Chesapeake & Ohio among
the larger railroads; the Bessemer & Lake
Erie in the second class, and the Lake
Superior & Ishpeming for the smaller roads.
Judge R. V. Fletcher, vice-president, A.
A. R., on the occasion of the Harriman
Memorial Medals Award, directed atten
tion to the fatalities
among employees were 1.47 for each billion
ton-miles. This, he said, was a better rec
ord than the railroads have made in the
last 26 years.

(*Turn to next left-hand page*)

HANDLING HEAVIER TRAINS WITH THE LOCOMOTIVE BOOSTER



*Trade Mark Reg. U. S. Pat. Off.

As trains have lengthened with the rush of wartime traffic, the problem of starting the heavier loads has become more difficult. » » » Booster-equipped locomotives have the added power for use in starting and in accelerating that is of exceptional value under today's operating conditions. » » » On thousands of locomotives, the Locomotive Booster* is making it possible to handle extra tonnage and meet exacting schedules.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

NEWS

WPB Authorizes Construction of 5,000 Box Cars

THE War Production Board has authorized the construction of 5,000 box cars in the latter part of this year and the early months of 1944 and may allot sufficient materials for the construction of 6,000 more, according to R. E. Clark, manager of the Closed Car section of the Association of American Railroads, in an address before the quarterly meeting of the Midwest Shippers Advisory Board at Chicago on July 8.

The board's campaign to get more freight cars and other equipment for the railroads was supported by a message from Joseph B. Eastman, director of the Office of Defense Transportation, which reiterated his previous statements that serious consequences may result if the ODT's requests for materials and equipment for the railroads are not met by the War Production Board. He added that the ODT will continue to press vigorously for more equipment, not only for the railroads but for the other forms of transportation.

How serious the car situation may become was indicated by W. F. Kirk, chairman of the Advisory Committee on Traffic Control of the Western Association of Railway Executives, who predicted that the war in the next year will cause increases in westbound freight traffic ranging from 7 to 50 per cent. He said that traffic volume in April on some Western railroads equalled the high for October, 1942, and that since April the volume has increased further. The volume in the week ended July 2, he continued, exceeded any movement to date since the war began. Terminal movements have increased as much as 40 per cent, he said, with that through Los Angeles, Calif., on July 2 exceeding anything thus far.

"I am not critical of WPB," Mr. Kirk stated, "but I think we should recognize two things. First, the time has come when our boys should have the goods to finish this job and second, transportation agencies must have the equipment to get the goods to the boys."

Plan to Double Locomotive Construction in 1944

A RECENT meeting in Washington, D. C., of the War Production Board Advisory Committee of the locomotive building industry brought out the fact that the 1944 construction program calls for doubling the "record-breaking" 1943 locomotive output.

Assurances were given the WPB representatives at the meeting that the industry not only would meet the "tremendous" program outlined for the rest of this year, but also would accomplish the increase in output asked of it for 1944—provided production of vital components keeps up with its requirements. This will be accomplished, the WPB hopes, through the controls over production scheduling embraced in Limitation Order L-97-d, which was made effective July 1 to insure completion of the 1944 locomotive building program and because the components are needed for repair parts, for the modernization and conversion of existing equipment and for export. Under the order WPB may direct the return or cancellation of orders for 54 critical component parts on the books of manufacturers, allocate orders as between manufacturers and direct changes in production and delivery schedules.

WPB and War Department representatives commended the locomotive builders for their co-operation in accomplishing a 200 per cent increase in production since Pearl Harbor. The Army program for the first half of 1943 was met in full, it was explained, and 92 per cent of the domestic railroad program was completed. The failure to meet fully the domestic quota was due not to the builders, it was pointed out by the WPB, but to delays they experienced in procuring vital components.

At the advisory board meeting the entire 1944 War Department program and all steam locomotives that have been ordered by domestic railroads were scheduled for production. It was pointed out that locomotive orders placed by domestic railroads after July 15 will have to be scheduled for production in the second half of 1944, due to the length of time required to order and procure materials.

Revised Status of Car and Locomotive Orders

RAILROAD orders for new freight cars for domestic service during the first six months of 1943 totaled 15,051 units, of which 11,750 were placed with contract car builders and 3,301 with railroad shops. Purchased from contract shops were 770 box, 8,650 hopper, 1,340 gondola and 990 flat cars. Orders from railroad shops included 1,000 hopper, 2,000 gondola and 301 flat cars.

Following the virtual cessation of new freight-car purchasing during the final six months of 1942, due to limited government-authorized building programs, the railroads re-entered the market in January in [illegible] volume ordering 10,385 cars. Deliveries during that month from railroad and contract shops, however, barely topped 2,[illegible] cars and each month thereafter failed to reach that number. New orders quickly dwindled to 980 cars in February, 1,[illegible] in March, 1,200 in April, 500 in May and 50 in June.

In addition to the 15,051 cars ordered by the railroads, industrial companies and private car lines placed orders for 353 cars for domestic service during the first six months of the year, comprising 107 gondola, 25 hopper, 17 flat, 200 tank and [illegible] dump cars and there were 439 cars ordered in the United States for export, exclusive of War Department orders, including [illegible] box, 38 tank, 16 dump and 175 ore cars. (Reports of the number of cars ordered or built for U. S. Government Department either for domestic service or for export are not permitted.)

The total backlog of cars on order for domestic service at July 1, 1943, amounted to 36,142 units. Included in this number were 65 cars remaining to be delivered under the War Production Board's 18,0[illegible] car program for the final eight months of 1942 and 16,361 cars representing the undelivered balance of the 20,000 cars authorized by the WPB in November, 19[illegible] for building during the six months ended June 30, 1943. In addition there were 19,716 cars without WPB approval to build. The 36,142 cars on order were allocated; 26,783 to contract car builders, including 1,700 auto, 4,324 box, 4,490 gondola, 13,526 hopper, 1,671 ore, 875 flat, [illegible] tank and 25 caboose cars, and 9,359 to railroad shops including 100 auto, 750 box, 3,000 gondola, 3,558 hopper, 401 flat, [illegible] stock, 1,200 refrigerator and 150 caboose cars.

As of July 1, only 3,639 or 18 per cent of the 20,000 cars authorized for production during the first six months of the year by the War Production Board had been built. Of the remaining 16,361, 13,[illegible] were on order with contract car builders including 3,331 gondola, 7,319 hopper, 1,[illegible] ore, 535 flat and 146 tank cars, and 3,[illegible] with railroad shops including 1,900 gon[illegible]

(*Continued on next left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the July Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Norfolk & Western	10[1]	2-6-6-4	Co. shops
Wheeling & Lake Erie	6[2]	Steam switch	American Loco. Co.
Erie	6[3]	5,400-hp. Diesel elec.	Electro-Motive Corp.

FREIGHT-CAR ORDERS

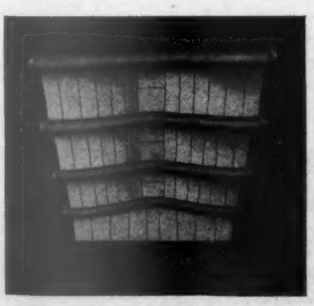
Road	No. of Cars	Type of Car	Builder
Alton	500	50-ton comp. hopper	Amer. Car & Fdry Co.

[1] These are in addition to 15 locomotives of the same type ordered in April, 1942, deliveries of which are now under way and are scheduled to be completed in September. Deliveries of the additional 10 engines are reported to be scheduled for the first six months of 1944.

[2] Subject to approval of WPB.

[3] Approximate cost of each locomotive $465,000. Reported for freight service between Marion, Ohio and Meadville, Pa.

Get Maximum Work from Each Pound of Coal



Every pound of coal involves scarce man-hours for its production and vital transportation to the point of use. Its economical use is essential.

For over 30 years the fuel savings of the Security Sectional Arch have been universally recognized by railroad men.

But only a complete arch can give the maximum in fuel economy. To this end see that every locomotive leaving the roundhouse has a full length arch.

HARBISON-WALKER REFRACTORIES CO.
Refractory Specialists

AMERICAN ARCH COMPANY, INC.
60 East 42nd Street, N. Y.

Locomotive Combustion Specialists

Railroad Steam Locomotive Building Program at July 1, 1943

(Covers Locomotives Authorized for Production by the War Production Board)

Railroad	Type	Number ordered	Approximate deliveries To July 1	Reported delivery schedule	Builder
Atchison, Topeka & Santa Fe	4-8-4	30	..	Aug.-Dec.'43	Baldwin
	2-10-4	20	..	Feb.-Mar.'44	Baldwin
Baltimore & Ohio	2-8-8-4	20	..	Dec.'43-Feb.'44	Baldwin
Bessemer & Lake Erie	2-10-4	10	..	Sept.-Oct.'43	Baldwin
Central of Georgia	4-8-4	8	..	July-Aug.'43	Lima
Chesapeake & Ohio	2-8-4	40	..	Oct.'43-Jan.'44	American
	2-6-6-6	10	..	Apr.-June '44	Lima
	0-8-0	5	..	August '43	Lima
	0-8-0	5	..	December '43	Lima
Chicago, Rock Island & Pacific	4-8-4	10	..	Feb.-Mar.'44	American
Detroit, Toledo & Ironton	2-8-2	4	..	March '44	Lima
Indianapolis Union	0-8-0	3	..	January '44	Baldwin
Lehigh & Hudson River	4-8-2	3	..	February '44	Baldwin
Lehigh Valley	4-8-4	10	..	October '43	American
Missouri Pacific	4-8-4	15	2	July-Aug.'43	Baldwin
Nashville, Chattanooga & St. Louis	4-8-4	10	..	September '43	American
New York Central	4-8-2	25	..	Aug.-Nov.'43	Lima
New York, Chicago & St. Louis	2-8-4	15	..	Dec.'43-Jan.'44	Lima
Norfolk & Western	2-6-6-4	15	10	July-Sept.'43	Co. shops
	4-8-4	6	..	Oct.-Dec.'43	Co. shops
	2-6-6-4	10	..	Feb.-June '44	Co. shops
Pennsylvania	2-10-4	110	60	July-Nov.'43	Co. shops
	2-10-4	40	..	Feb.-June '44	Co. shops
Pere Marquette	2-8-4	12	..	Feb.-Mar.'44	Lima
Pittsburgh & Lake Erie	0-8-0	25	..	Feb.-Apr.'44	American
St. Louis-San Francisco	4-8-4	10	..	July-Aug.'43	Baldwin
Southern Pacific	4-8-8-2	20	..	Sept.-Dec.'43	Baldwin
	4-8-4	10	4	July-Aug.'43	Lima
Union	0-6-0	10	..	January '44	American
Union Pacific	4-6-6-4	25	4	July-Sept.'43	American

dola, 1,058 hopper and 401 flat cars. Evidencing this serious lag in freight-car production due to the continued shortage of materials, in all 24 railroads and eight private car lines on July 1 were awaiting deliveries of these 16,361 cars originally scheduled for production during the first six months of 1943 in accordance with government authorizations.

The 19,716 cars without WPB authority to build at July 1 comprised 13,716 on car builders' books, including 1,700 auto, 4,324 box, 1,120 gondola, 6,207 hopper, 340 flat and 25 caboose cars and 6,000 ordered from company shops, including 100 auto, 750 box, 1,100 gondola, 2,500 hopper, 200 stock, 1,200 refrigerator and 150 caboose cars.

The accompanying table shows as of July 1, 1943, a detailed list of locomotives scheduled to be built during the twelve months July, 1943-June, 1944, for delivery to domestic railroads in accordance with War Production Board authorizations.

The individual orders shown for these locomotives and WPB authorizations to build have been previously reported in the table of "Orders and Inquiries for New Equipment" which appears each month in these columns, and most of the orders were grouped in a table showing the month ordered in the April issue of the *Railway Mechanical Engineer*, page 116.

Included in the list are 536 locomotives, designed chiefly for freight service, of which 80 were delivered prior to July 1. Of the remaining 456, railroad shops will build 111 and the three contract builders 345.

Certain of the orders listed were placed in part in 1942 and increased in size early this year when the WPB approved the building of a larger number of locomotives for these partciular carriers than were already on order.

In addition to the steam locomotives listed in the accompanying table, there were on July 1 approximately 450 Diesel-electric locomotives authorized and scheduled for production during the subsequent nine months July, 1943-March, 1944. Of these about 85 were freight engines of 5,400-hp. each, ten of 2,000-hp. and the balance road and switching engines of 1,000 or 660 hp. The Diesel engines reportedly will be turned out at the rate of between 45 and 55 per month.

The Locomotive Institute Research Study

For some years The Locomotive Institute has been carrying on intensive studies in connection with steam locomotive design and performance through a committee of their technical representatives. Many subjects have been handled and methods adopted, all with the object of improving performance, reducing maintenance costs, and providing greater reliability and efficiency of the locomotive. Positive and advantageous results have accrued from these activities.

The necessary contribution to the war effort of all the locomotive builders has, to a certain extent, limited the time available to their technical staffs for steady prosecution of these studies. The Institute, with a full realization of the importance of continuous stress on war work, is also fully aware of the contribution being made daily by the railroads of the country in the handling of war materials, troops and supplies, no small part of which was due to their locomotive inventory. With this in mind and looking ahead to post-war transportation, it was decided that for the steam locomotive to maintain its position as the main reliance of railroad transportation throughout the world, these studies, already started, must be carried on without loss of time, and they have recently set up an organization to handle the work.

Lawford H. Fry was appointed director of research of The Locomotive Institute on July 1. His entire time will be devoted to research work in connection with locomotive design, under the jurisdiction of the Technical Committee of the Institute. Studies already under way in connection with motive power will be accelerated and a thorough investigation made of recent accomplishments that have already resulted in improving the performance of the steam locomotive to a point where yearly mileages more than double what they were a few years ago.

Mr. Fry's background is such as to make him eminently qualified for the work he is undertaking. Many years experience in the engineering and testing departments of The Baldwin Locomotive Works at Philadelphia, metallurgical and engineering experience with the Standard Steel Works and the Edgewater Steel Company, as well as several years experience abroad will stand him in good stead. He will be assisted in his work by the technical experts of the locomotive builders. His headquarters will be at 60 East 42nd street, New York, where offices and engineering facilities will be maintained.

Diesel-Electric Switcher Standardization

Standardization of Diesel-electric switching locomotives is here to stay, according to a statement made by G. W. Wilson, manager, transportation department, General Electric Company, in which he says: "It offers the ultimate user too much in terms of proved performance, quick delivery, low price and simplified maintenance for him to revert to the pre-war practice of a special design for every occasion. Locomotive manufacturers will revise the standard designs periodically to incorporate the latest developments—may even have locomotive shows to introduce their new models." He estimates that standardization of G-E switching locomotives and carefully planned production added more than 185 locomotive years of switching to the war effort in 1942.

According to Mr. Wilson, through the use of the standard locomotive, the time consumed in design work, engineering and drafting before material can be ordered and the shop started on a "tailor-made" locomotive can easily be cut in half. Moreover, this vital gain in time sacrifices nothing in performance and releases valuable skilled man-hours for other war work, to say nothing of simplified maintenance. The standard locomotive has already proved itself in hundreds of installations, and it is simply a matter of ordering the proper size to do the job.

Many operators badly in need of switchers, who formerly ordered specials, took standard units because of the quick delivery. They were so pleased with the performance that they henceforth ordered standard units.

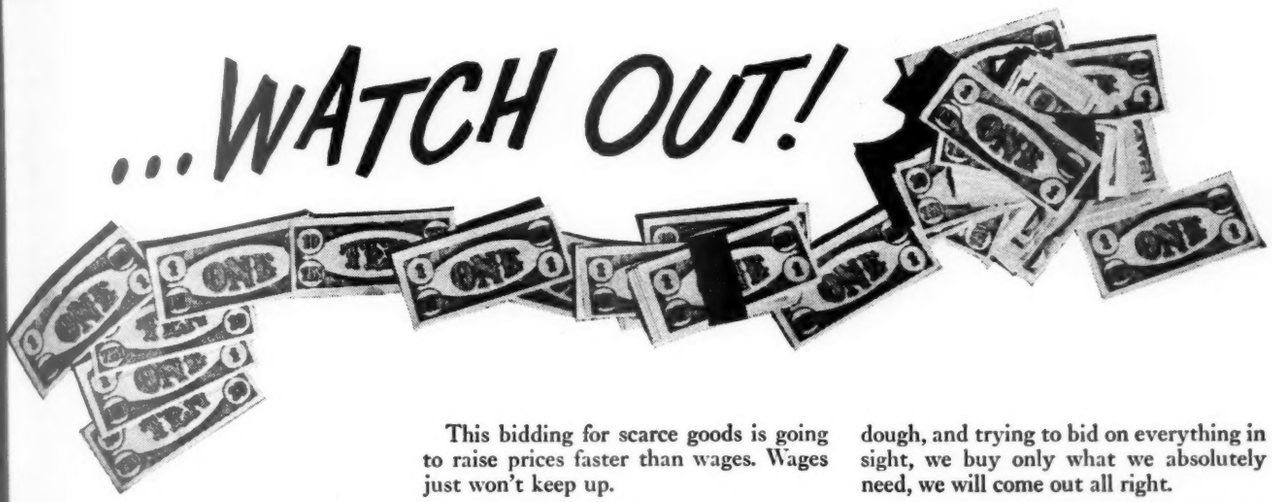
Car Supply via the Repair Route

Indications that the railroads have about reached the limit of what they can do in the way of making more serviceable cars via the repair route were seen in reports discussed at the June 25 meeting of the Association of American Railroads board of directors in Washington. As of June 1, the number of serviceable cars totaled 1,691,750, a decrease of 3,750 below the previous month; and the bad order percentage was down to 2.8 per cent.

(*Continued on second left-hand page*)

IF YOU'RE MAKING MORE MONEY

...WATCH OUT!



WE WANT TO WARN YOU, before you read this page, that you've got to use your head to understand it.

We also want to warn you that—if you don't bother to read it carefully enough to understand it—you may wake up after this war as poor as a church mouse.

• • •

This year Americans are going to make—minus taxes—125 billion dollars.

But this year, we civilians are not going to have 125 billion dollars' worth of goods to spend this on. We're only going to have 80 billion dollars' worth. The rest of our goods are being used to fight the war.

That leaves 45 billion dollars' worth of money burning in our jeans.

Well, we can do 2 things with this 45 billion dollars. One will make us all poor after the war. The other way will make us decently prosperous.

This way the 45 billion dollars will make us poor

If each of us should take his share of this 45 billion dollars (which averages approximately $330 per person) and hustle out to buy all he could with it—what would happen is what happens at an auction where every farmer there wants a horse that's up for sale.

If we tried to buy all we wanted, we would bid the prices of things up and up and up. Instead of paying $10 for a dress we're going to pay $15. Instead of $5 for a pair of shoes we're going to pay $8.

This bidding for scarce goods is going to raise prices faster than wages. Wages just won't keep up.

So what will people do?

U. S. workers will ask for more money. Since labor is scarce, a lot of them will get it. Then farmers and business men who

feel the pinch are going to ask more money for their goods.

And prices will go *still higher*. And the majority of us will be in that same old spot again—only worse.

This is what is known as Inflation.

Our government is doing a lot of things to keep prices down . . . rationing the scarcest goods, putting ceiling prices on things, stabilizing wages, increasing taxes.

But the government can't do the *whole job*. So let's see what *we* can do about it.

This way the 45 billion dollars will make us prosperous

If, instead of running out with our extra dough, and trying to bid on everything in sight, we buy only what we absolutely need, we will come out all right.

If, for instance, we put this money into (1) Taxes; (2) War Bonds; (3) Paying off old debts; (4) Life Insurance; and (5) The Bank, we don't bid up the prices of goods at all. And if besides doing this we (6) refuse to pay more than the ceiling prices; and (7) ask no more for what we have to sell—no more in wages, no more for goods—*prices stay where they are now.*

And we pile up a bank account. We have our family protected in case we die. We have War Bonds that'll make the down payment on a new house after the war, or help us retire some day. And we don't have taxes after the war that practically strangle us.

Maybe, doing this sounds as if it isn't fun. But being shot at up at the front isn't fun, either. You have a duty to those soldiers as well as to yourself. You *can't* let the money that's burning a hole in your pocket start setting the country on fire.

★ ★ ★

This advertisement, prepared by the War Advertising Council, is contributed by this Magazine in co-operation with the Magazine Publishers of America.

KEEP PRICES DOWN!

Use it up
Wear it out
Make it do
Or do without

GM DIESEL LOCOMOTIVE

REQUIRES ONLY SIMPLE MAINTENANCE FAC

SOUTHERN RAILWAY
DIESEL MAINTENANCE SHOP
LUDLOW, KY.

GENERAL MOTORS
LOCOMOTIVES

DESIGN
NC FACILITIES...

THE philosophy back of Electro-Motive basic design was, and still is, simplicity of construction, ease of operation and maintenance, interchangeability of standardized parts completely finished and ready for application.

The success of this thinking is best evidenced by the outstanding performance of some 1200 General Motors Diesel Locomotive Units, now operating in all classes of service.

The adequate and efficient, yet inexpensive, maintenance facilities of the Southern Railway at Ludlow, Kentucky, here illustrated, are typical of the present trend of railroads using GM Diesel Locomotives.

KEEP AMERICA STRONG
BUY MORE WAR BONDS

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION — LA GRANGE, ILLINOIS, U.S.A.

Thus it was suggested that the time is fast approaching, if it is not already here, when the railroads must have more new cars if they are going to "hold the line" on the supply of serviceable. The car supply situation was among subjects discussed at the meeting, where there was consideration also of the motive power situation.

720th Railway Operating Battalion Activated

THE 720th Railway Operating Battalion, sponsored by the Chicago and North Western, was activated on July 6, when 20 officers from the railway's personnel left for training camp. Enlisted men will be assigned to the battalion during the training period.

Heading the 720th Battalion is Lt. Col. C. J. Freeman, the commanding officer or "division superintendent", formerly right of way agent of the North Western's land department. Capt. C. B. Coyle, mechanic on the Wisconsin division, will command Company B as "master mechanic." First Lt. V. L. Duncan, relief roundhouse foreman at Chadron will be "enginehouse foreman."

The task of "general car foreman" is taken over by First Lt. Walter S. Ryall, car foreman at California Avenue. Second Lt. J. H. Larsen, engineer, Chicago freight terminals, will be "assistant to master mechanic." Commanding Company C, or the Transportation Company, is Capt. D. J. McLaughlin, yardmaster at Proviso. First Lts. C. S. Smith and Stewart St. John, Wisconsin division locomotive engineers, will be "road foremen of engines."

Allied Railway Supply Association Officers

THE executive committee of the Allied Railway Supply Association, Inc., in accord with the by-laws and constitution, have unanimously elected the following officers of the association: President and treasurer, C. F. Weil, American Brake Shoe & Foundry Company; first vice-president, M. K. Tate, Lima Locomotive Works; second vice-president, E. H. Weaver, Westinghouse Air Brake Company; third vice-president, B. S. Johnson, W. H. Miner, Inc.; and fourth vice-president, J. J. Cizek, the Leslie Company. This election was necessary because of the death of J. W. Fogg, who was president, and of F. W. Venton, treasurer.

Russia Here for "Enormous" Locomotive Order

THE Russians are in this country for an "enormous order" for locomotives, Major General C. P. Gross, chief of the Army's Transportation Corps, recently told a House appropriations subcommittee which was considering the Military Establishment Appropriation Bill for the fiscal year ending June 30, 1944.

General Gross did not say how many locomotives are involved in the Russian request, but he did reveal that this country has sent "quite a little" rolling stock to the Middle East. He went on to say that the shipping route to the Persian Gulf, and up to the Russian front there is being "highly developed"; and "approximately $35,000,000 worth of rolling stock has either been shipped from American ports to the Near East, or is in part being held at the ports ready for shipment."

"This rolling stock," General Gross added, "has gone to many different places and is now being utilized to make up the shortage that was apparent in several locations." He also revealed that the United States "sent some hundred locomotives to Africa prior to the fall of Tunisia." Speaking briefly about Brigadier General Carl R. Gray's Military Railway Service on the African front, General Gross called the outfit "a nicely balanced unit" of "some 6,000" railway troops.

Railroads Need Better Break Says General Gross

MAJOR GENERAL C. P. GROSS, chief of the Army Transportation Corps, in recently released testimony given before a House appropriations subcommittee which considered the Military Establishment Appropriation Bill for the fiscal year 1944, said that he does not think that the carriers have thus far "been given as favorable a break as they should have" by the allocation authorities at the War Production Board, "particularly in connection with locomotives." This statement was in response to a question asked by Representative Starnes of Alabama if in his opinion WPB "should give more sympathetic consideration to any application for priorities from the railroad systems of the country for replacement, repair, or maintenance of the railroads in order to make sure that an effective job is being done."

Commenting on the condition of railroad equipment, General Gross said "there is one railroad that is stumbling right now. It is beginning to have congestion. It is a sore spot." The general did not name the road, but his testimony carried the implication that it was in the West. The road, he went on, "will say" it lacks Diesel locomotives; but the general thinks there "has been an indisposition to take steam locomotives," with the result that railroads "have not put as many orders on the books for the kind [of locomotives] that they can get as I think they should.

"We have not stretched the use of the Pacific railroads as yet," General Gross continued. "When we go into the Pacific war we will throw a whole lot more onto those railroads than they now have. The Pacific coast is fed, from an expert's standpoint, by a rather tenuous rail system. . . . I believe there is a great danger because of lack of equipment. It may be that if this railroad finds itself in real and crying need for Diesels, the Office of Defense Transportation would take some away from other railroads and shoot them out."

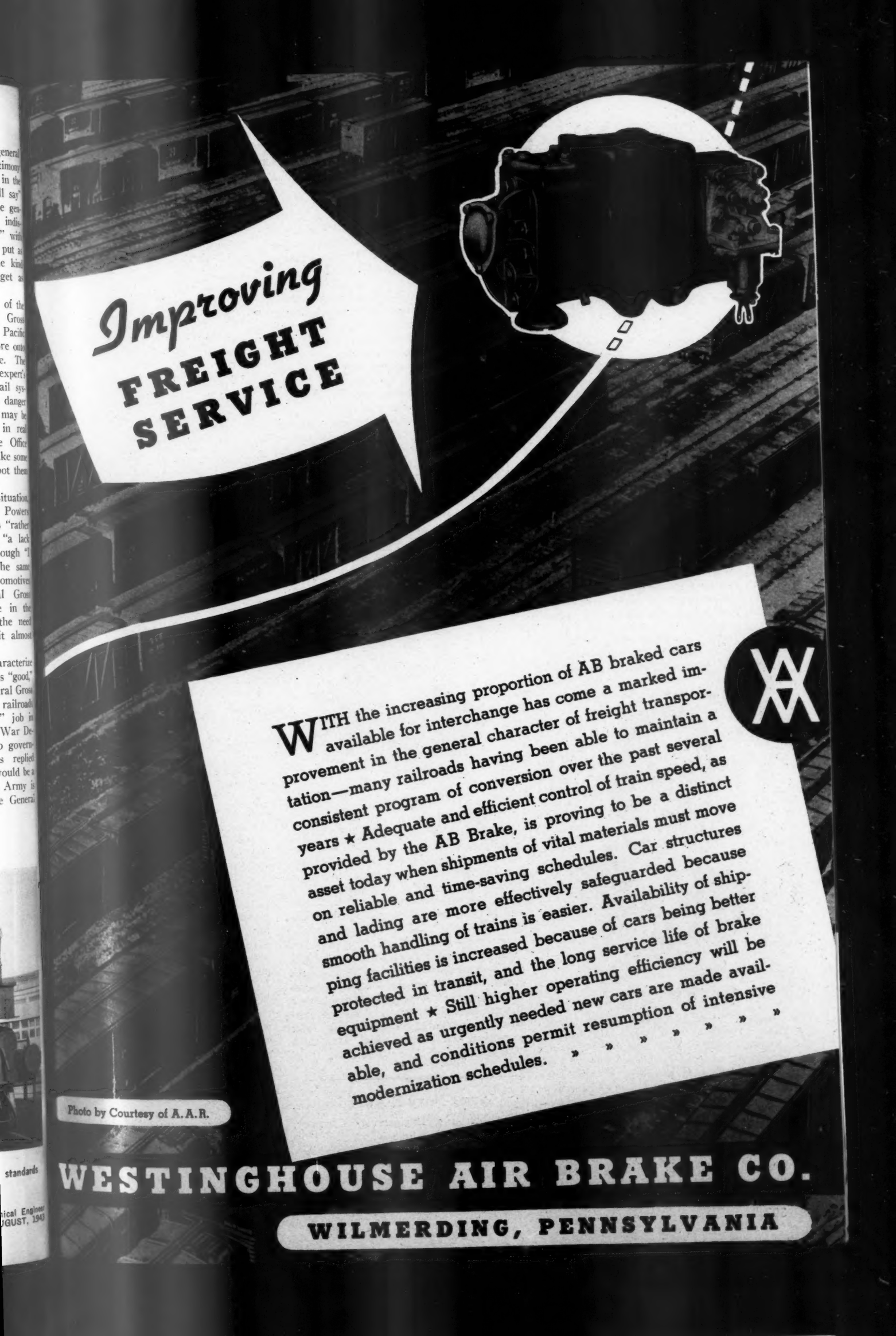
With respect to the freight car situation, General Gross told Representative Powers of New Jersey, that the surplus is "rather low." The railroads fear most "a lack of gondolas and flat cars," although "I do not think they put this in the same category as the problem of locomotives and renewal of rail." General Gross earlier had said that there are in the rail situation "indications that the need is coming, and close, to make it almost a first priority."

Asked by Mr. Starnes to characterize the performance of the railroads as "good," "excellent," or "superlative," General Gross told the subcommittee that the railroads have been doing a "superlative" job in meeting the requirements of the War Department. Prodded further as to government ownership, General Gross replied that the government-operation "would be a disaster." The cooperation the Army is receiving from the railroads, the General said, "could not be any better."

* * *

A string of army locomotives from Baldwin—Designed for areas where European standards prevail, as coupling and buffing mechanisms reveal

(*Turn to next left-hand page*)


Improving
FREIGHT
SERVICE
WITH the increasing proportion of AB braked cars available for interchange has come a marked improvement in the general character of freight transportation—many railroads having been able to maintain a consistent program of conversion over the past several years ★ Adequate and efficient control of train speed, as provided by the AB Brake, is proving to be a distinct asset today when shipments of vital materials must move on reliable and time-saving schedules. Car structures and lading are more effectively safeguarded because smooth handling of trains is easier. Availability of shipping facilities is increased because of cars being better protected in transit, and the long service life of brake equipment ★ Still higher operating efficiency will be achieved as urgently needed new cars are made available, and conditions permit resumption of intensive modernization schedules. » » » » » »
Photo by Courtesy of A.A.R.
WESTINGHOUSE AIR BRAKE CO.
WILMERDING, PENNSYLVANIA

Supply Trade Notes

PANTASOTE CO., INC.—*Peter J. Hickey,* general sales manager, has been elected vice-president of Pantasote Co., Inc.

◆

UNITED STATES STEEL SUPPLY COMPANY.—*M. Frank Dresmal,* manager of machinery sales of the United States Steel Supply Company, has been appointed office manager of the Chicago sales department.

◆

KOPPERS COMPANY.—*E. A. Koether,* works manager since 1936 of the Koppers Company, American Hammered Piston Ring Division, has been promoted to the newly created position of technical assistant to the vice-president and general manager of the division. *Edgar S. Freeman, Jr.,* assistant sales manager, succeeds Mr. Koether as works manager.

◆

AMERICAN LOCOMOTIVE COMPANY.—*James D. Vaughan* has been appointed executive assistant to the president of the American Locomotive Company. Mr. Vaughan became associated with the company in 1937 as assistant to the then president William C. Dickerman, who is now chairman of the board.

◆

LUKENS STEEL COMPANY.—*C. T. Hansen & Company,* for twelve years representative in Detroit, Mich., of Lukens Steel Company, has been appointed Pacific Coast sales representative of Lukens and subsidiaries, By-Products Steel Corporation, and Lukenweld, Inc., Coatesville, Pa. Offices have been opened by the Hansen Company at 530 West Sixth street, Los

C. T. Hansen

Angeles, Calif.; 235 Montgomery street, San Francisco, Calif., and 1319 Second avenue, Seattle, Wash. *C. T. Hansen,* president, who has established residence in San Francisco, is in charge of these offices.

◆

DOW CHEMICAL COMPANY.—The Dow Chemical Company, Midland, Mich., has reorganized its Plastic Sales division and formed a Plastic Development and Service division. *D. L. Gibb,* who has been affiliated with the company for the last 20 years, has been made manager of the Plastics Sales division and *W. O. Goggin,* who during the seven years he has engaged in research on resins and plastics, has been placed in charge of the Plastic Development and Service division.

◆

GOULD STORAGE BATTERY CORPORATION.—*C. A. Walker* has been appointed sales engineer for Alabama, Mississippi, New Orleans and Baton Rouge in Louisiana, and Tennessee west of and including Chattanooga. His headquarters are at 649 Fulton avenue, W.E., Birmingham, Ala.

Mr. Walker studied business administration at the University of Alabama until 1934, when he left to become a manufacturer's agent for I.X.L. Laboratories of Chicago. Three years later he joined the Manhattan Rubber Mfg. Co., a division of Raybestos-Manhattan, as manager of the warehouse and service department in their Birmingham plant. In 1938 he accepted a

C. A. Walker

position with the Hood Rubber Company, a subsidiary of B. F. Goodrich, as a sales representative in Tennessee and Kentucky. He returned to the Manhattan Company in 1940 to take charge of their Southern District and become manager of the order and priorities department at the Birmingham office.

◆

ELWELL-PARKER ELECTRIC COMPANY.—*C. B. Cook,* who has been identified with the Elwell-Parker Electric Company, Cleveland, Ohio, for 28 years and has been a director since 1941, has been elected vice-president in charge of advertising, sales promotion and export sales. Mr. Cook is a graduate of Rose Polytechnic Institute. He continued his engineering education through an apprenticeship course at the Bullock Works of the Allis-Chalmers Manufacturing Company, becoming a member of its sales force in Cleveland in 19

C. B. Cook

From 1908 to 1912, he was manager of the Toledo office of this company, and from 1912 to 1914 was Ohio and Michigan district manager of the Stevens-Duryea Company. In 1914 Mr. Cook became affiliated with the Elwell-Parker Electric Company, to organize sales-promotion.

Army-Navy E Awards

Chambersburg Engineering Company, Chambersburg, Pa. June 25.

National Malleable and Steel Castings Company, Indianapolis, Ind. June 25.

Sylvania Electric Products, Inc., Emporium, Pa. June 22.

Obituary

WILLIAM B. GILLIES, vice-president of the Youngstown Sheet & Tube Co., Youngstown, Ohio, died in that city on June 2

◆

CARL T. MEADE, resident manager of the Standard Stoker Company with headquarters at Montreal, Canada, died on June 21. He was 49 years of age.

◆

CHARLES PACKARD, field sales representative of the Simmons-Boardman Publishing Corporation, died suddenly at St. Paul, Minn., on July 2. He was 67 years of age. Mr. Packard was widely known among railroad and railroad supply men in the middle west. He had been associated with the Simmons-Boardman circulation department since 1926, having been formerly with the Railway Review, which was merged into the Railway Age at that time.

◆

JAMES A. SEYMOUR, former president and chairman of the McIntosh & Seymour Corporation, now a part of the American Locomotive Company, died on June 28. Mr. Seymour was 78 years of age. He was a graduate of the Sheffield Scientific School of Yale University in 1885. With John F. McIntosh, he founded the McIntosh & Seymour Corporation in 1886, and served as the company's president and, later, as chairman of the board until his retirement in 1922. The company became a wholly owned subsidiary of the American Locomotive Company in 1929, and was subsequently merged with it.

Personal Mention

General

J. S. Netherwood, assistant superintendent of motive power and equipment of the Southern Pacific Lines in Texas & Louisiana, has been appointed superintendent of motive power and equipment, with headquarters as before at Houston, Tex. Mr. Netherwood was born at Lohn, Tex., on November 18, 1889, and in 1911 was a graduate in mechanical engineering from the Texas Agricultural and Mechanical College. He entered railway service in the same year as a draftsman in the employ

Joseph S. Netherwood

of the Texas & New Orleans (now part of the Southern Pacific Lines in Texas and Louisiana). In 1913 he was promoted to the position of chief draftsman at Houston and five years later became mechanical engineer. In 1924 Mr. Netherwood was appointed assistant superintendent of motive power and equipment, with headquarters at Algiers, La., and two years later was transferred to Houston.

Harry M. Wood, superintendent of the Logansport division of the Pennsylvania at Logansport, Ind., has been appointed general superintendent of motive power of

Harry M. Wood

the Western region, with headquarters at Chicago. Mr. Wood was born in Altoona, Pa., on June 4, 1901, and was educated at Pennsylvania State College. He entered railway service as a clerk in the Altoona shops of the Pennsylvania on July 7, 1919. He became a machinist apprentice on June 15, 1922; a special apprentice in 1925, and motive power inspector in 1927. In 1930 he went to Harrisburg, Pa., as a gang foreman and five years later became assistant foreman at Enola yard, Harrisburg. He was advanced to the position of assistant master mechanic on the Pittsburgh division in 1936, and was appointed master mechanic of the Long Island on August 1, 1937. He returned to the Pittsburgh division of the Pennsylvania as acting master mechanic on May 16, 1941; on December 1, 1941, became master mechanic of the Western Pennsylvania general division, consisting of the Pittsburgh, Conemaugh and Monongahela divisions, and in February, 1942, was promoted to the position of superintendent of the Logansport division.

Darrell D. Alton, assistant master mechanic of the Southern Pacific Lines in Texas and Louisiana, at El Paso, Tex., has been appointed assistant superintendent of motive power and equipment, with headquarters at Houston, Tex. Mr. Alton was born at Fremont, Mich., on July 24, 1894, and is a graduate of the University of Michigan. In 1923 he became a draftsman of the Texas & New Orleans (now part of the Southern Pacific Lines in Texas and Louisiana), with headquarters at Houston, and later served as special engineer. In 1941 Mr. Alton was advanced to the position of assistant master meechanic.

Darrell D. Alton

A. I. Sellers, superintendent of shops of the Southern Pacific Lines in Texas and Louisiana at Houston, Tex., has been appointed chief assistant superintendent of motive power and equipment, with headquarters at Houston. Mr. Sellers was born at Houston on October 24, 1899, and entered railway service in 1912 as a messenger of the telegraph department at Houston. He subsequently served in various capacities in the legal department and the general claims department and in 1914 became an apprentice in the Houston shops. He served with the United States Army during World War I, and then returned

Adrian I. Sellers

to Houston in 1920 to complete his apprenticeship. Mr. Sellers served as machinist, enginehouse foreman and general shop foreman and in 1932 became superintendent of shops at Houston.

William Y. Cherry, general superintendent of motive power of the Western region of the Pennsylvania, with headquarters at Chicago, has retired. Mr. Cherry was born in Fort Wayne, Ind., on June 21, 1873, and entered the service of the Pennsylvania as a boilermaker apprentice at Fort Wayne on June 14, 1887. He served in various capacities until 1907, when he became machine-shop foreman at Wellsville, Ohio. He was promoted to

William Y. Cherry

the position of enginehouse foreman at Allegheny, N. Y., in 1912, and became master mechanic at Grand Rapids, Mich., in 1917. In 1920, Mr. Cherry was appointed superintendent of motive power at Cleveland, Ohio, and in February, 1928, was transferred to the Long Island. In October, 1928, he became superintendent of motive

(*Continued on second left-hand page*)

AGAIN the WAR

Locomotive Characteristics

Weight on Drivers	270,000 Lb.
Weight of Engine	470,000 Lb.
Cylinders	24½ x 32 Ins.
Diameter of Drivers	75 Ins.
Boiler Pressure	285 Lb.
Tractive Power	62,040 Lb.
Tender Capacity—Water	20,000 Gals.
Tender Capacity—Fuel	25 Tons

★ ★ ★ ★ ★ ★ ★

FOR VICTORY BUY U. S. WAR BONDS AND STAMPS

WARTIME PACE ★ ★ ★
goes up on the
DELAWARE & HUDSON

Fifteen 4-8-4's have recently been delivered by Alco to the Delaware & Hudson. This makes a fleet of 50 — fifteen 4-8-4's and thirty-five 4-6-6-4's — high-speed, high-powered, heavy tonnage locomotives which Alco has delivered to this road since July 1940.

Alco AMERICAN LOCOMOTIVE

MANUFACTURERS OF MOBILE POWER

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES & OTHER ORDNANCE

power of the New York zone of the Pennsylvania and on December 1, 1936, was appointed general superintendent of motive power of the Western region.

GEORGE H. MASSY, assistant superintendent of motive power and rolling equipment of the Central of New Jersey, has been appointed superintendent of motive power and rolling equipment of the Central of New Jersey, with headquarters as before at Elizabethport, N. J. Mr. Massy was born on April 25, 1889, at Jamaica, British West Indies. He entered the service of the Central of New Jersey as a helper apprentice on March 25, 1908, and

George H. Massy

became a machinist in 1910. In 1916 he was promoted to the position of assistant foreman, Bayonne (N. J.) enginehouse. On August 1, 1925, he became enginehouse foreman at Elizabethport engine terminal; on March 17, 1926, general mechanical inspector at New York; on March 1, 1929, assistant master mechanic at Communipaw (N. J.) engine terminal; on January 1, 1933, division master mechanic in charge of the Central and Southern subdivisions, and in January, 1942, assistant superintendent of motive power and rolling equipment.

GEORGE A. SILVA, superintendent of the Billerica (Mass.) locomotive repair shops of the Boston & Maine, has been appointed superintendent of locomotive maintenance of the Boston & Maine, Maine Central and the Portland Terminal Company, with headquarters at Boston, Mass., and Portland, Me.

H. S. WALL, mechanical superintendent of the Atchison, Topeka & Santa Fe at Los Angeles, Calif., retired on July 1 after 43 years' service. Mr. Wall was born at Hamilton, Ont., on August 24, 1874, and entered the employ of the Santa Fe in October, 1899, as a machinist at Albuquerque, N. M. On April 1, 1900, he was appointed enginehouse foreman at Needles, Calif. On July 1, 1900, he became general foreman; on August 15, 1900, division foreman at Barstow, Calif.; May 1, 1906, master mechanic at Winslow, Ariz.; on October 21, master mechanic at Needles; on July 1, 1909, shop superintendent at San Bernardino, Calif., and in April, 1918, mechanical superintendent at Los Angeles.

JOHN A. POWER, superintendent of motive power and equipment of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Houston, Tex., has retired. Mr. Power was born in Ireland in 1873. On coming to America he took employment with the Texas & New Orleans, now a part of the Southern Pacific, in Texas and Louisiana, in 1893, as an apprentice in the mechanical department. Subsequently, he became a machinist, gang foreman, machine-shop foreman, enginehouse foreman, general foreman and superintendent of shops. In 1916 he was appointed assistant general manager, with headquarters at Houston; in August, 1918, mechanical superintendent, and in 1920, superintendent of motive power and equipment.

GEORGE S. WEBB, master mechanic of the Chicago Terminal and Logansport divisions of the Pennsylvania, has been appointed superintendent of motive power of the Southern division, with headquarters at Wilmington, Del., succeeding H. H. Maxfield, who has been granted leave of absence.

JAMES W. ATKINSON, division master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed mechanical superintendent at Ft. Madison, Ia.

G. B. HALSTEAD, general foreman, car department, of the Virginian, has been appointed assistant to superintendent motive power, with headquarters as before at Princeton, W. Va.

Car Department

E. D. GRIFFITH has been appointed general car inspector of the Southern Pacific, with headquarters at San Francisco, Calif.

E. M. FORBES, car foreman of the Virginian at Elmore, W. Va., has been appointed general foreman, car department, at Princeton, W. Va.

Master Mechanics and Road Foremen

C. L. EMERSON, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Chicago, has retired.

J. J. MEYERS, supervisor of locomotive maintenance of the New York, Ontario & Western, has been promoted to the position of master mechanic at Middletown, N. Y.

M. T. LLEWELLYN, general foreman of the Chesapeake & Ohio at Clifton Forge, Va., has been appointed to the newly created position of master mechanic at Ashland, Ky.

L. H. RABUN, assistant master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Bensonville, Ill., has been appointed master mechanic, with headquarters at Savanna, Ill.

P. B. RICE has been appointed master mechanic of the Southern Pacific, Lines in Texas and Louisiana, with headquarters at Houston, Tex.

J. R. KEELEY, acting master mechanic of the Virginian at Victoria, Va., has been appointed master mechanic at Victoria.

STANLEY W. SHIRLEY, assistant master mechanic of the Eastern division of the Pennsylvania at Conway, Pa., has been appointed master mechanic of the Chicago Terminal and Logansport divisions, with headquarters at Chicago.

JOHN G. DANNEBERG, master mechanic of the Atchison, Topeka & Santa Fe at Arkansas City, Kan., has been appointed division master mechanic, with headquarters at Argentine, Kan.

Shop and Enginehouse

J. E. POHLMAN, erecting shop foreman of the New York, Ontario & Western, has been promoted to the position of general foreman at Middletown, N. Y.

H. J. BOWYER, acting general locomotive foreman of the Southern Pacific Lines in Texas and Louisiana, has been appointed superintendent of shops at Houston, Tex.

G. BLYBORG, general foreman of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn., has been appointed shop superintendent, with headquarters at Minneapolis.

WALTER H. OHNESORGE, assistant superintendent of the locomotive repair shops of the Boston & Maine at Billerica, Mass., has been appointed superintendent of the locomotive repair shops at Billerica.

LEROY E. LEONARD, a draftsman in the employ of the New York, Ontario & Western, has been promoted to the position of shop engineer, with headquarters at Middletown, N. Y.

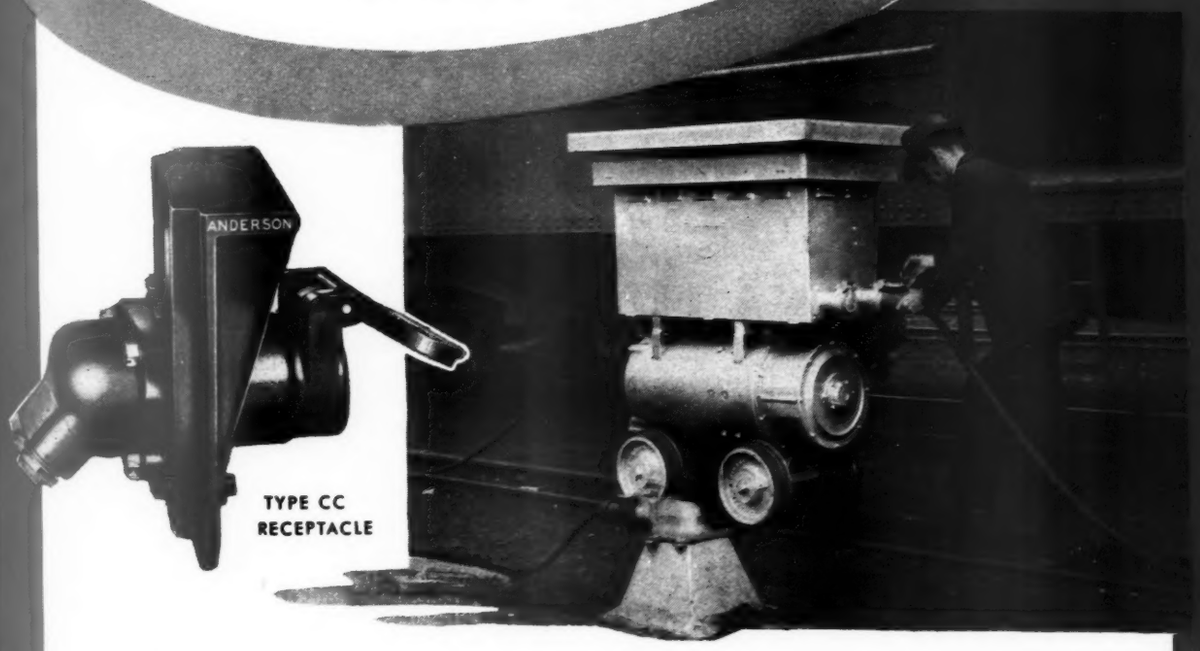
Obituary

H. E. RICCUS, shop superintendent of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn., died in that city on June 6.

EDWIN J. KUECK, assistant superintendent of motive power of the St. Louis-Southwestern at Pine Bluff, Ark., died in a hospital at Texarkana, Ark., on June 2[illegible]. A sketch and photograph of Mr. Kueck appeared in the May *Railway Mechanical Engineer* at the time of his appointment to the position of assistant superintendent of motive power.

BENJAMIN E. JONES, master mechanic of the Erie at Secaucus, N. J., died suddenly at his home in Rutherford, N. J., on June 12. Mr. Jones entered the employ of the Erie at Marion, Ohio, in 1913 and served in various positions there until March, 1930, when he was appointed general supervisor of motor cars at the New York general offices. Later that year he went to Hornell, N. Y., as master mechanic. In 1932 he became general supervisor of motor cars at Cleveland, Ohio, and, in 1933, master mechanic, motor equipment, Susquehanna. He was master mechanic at Buffalo, N. Y., from March 1, 1938, to October 1, 1941, when he was transferred to Secaucus.

ALL ANDERSON PLUGS AND RECEPTACLES IN THIS INSTALLATION



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ARMY E NAVY

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